CMAG

CASE MANAGEMENT
ADHERENCE GUIDELINES

VERSION 1.0
DIABETES

Guidelines from the Case Management Society of America for improving patient adherence to diabetes medication therapies

November 2007

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# DIABETES

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Introduction

In 2004, the Case Management Society of America (CMSA) introduced a set of guiding principles and associated tools that were developed to aid in the assessment, planning, facilitation and advocacy of patient adherence. Entitled the Case Management Adherence Guidelines (CMAG), these concepts were designed to advance the goal of creating an environment of structured interaction, based on patient-specific needs that would encourage patient adherence with all aspects of the prescribed treatment plan.

Over the ensuing years, thousands of healthcare professionals attended CMAG educational workshops throughout the United States. CMAG Workbooks that comprehensively detail all CMAG tools and supportive knowledge were made available in multiple languages, including English, Spanish, French and Korean. Subsequently, CMAG was recognized as the primary educational standard for case managers that present a collaborative approach for affecting patient-specific health behavior change and for advancing patient adherence.

This addendum to the basic CMAG program utilizes the primary concepts of motivational interviewing, assessment of health literacy and implementation of adherence improvement tools to promote adherence in the patient who is diagnosed with or at risk for developing diabetes.

Case managers and other healthcare clinicians and professionals who work with these patients will find the tools and resources found in this addendum specifically targeted to address understanding of the disease as well as adherence challenges and assessments that are specific to diabetes.

CMSA continues to provide CMAG educational workshops throughout the United States. Copies of the CMAG manual and this Disease State Chapter addendum may be downloaded at no cost at www.cmsa.org/cmag.
DIABETES

In this volume we will review the following:

Discuss type 1 and type 2 diabetes diagnosis.

Describe the prevalence of diabetes mellitus in the U.S.

Review the complications of diabetes.

Examine the economic impact of diabetes.

Identify prevalent treatment modalities for cardiometabolic syndrome and diabetes.

Discuss the AADE 7 and implications for adherence, which include:

- Medication
- Diet
- Exercise
- Self monitoring of glucose levels
- Coping with the disease and change of lifestyle
- Problem solving and reducing risk.

Identify adherence challenges.

Review CMAG assessment and intervention tools specific to the individual with diabetes.

Discuss resources available for individuals with diabetes as well as for healthcare professionals.
Diabetes

*Genetics may load the cannon, but human behavior pulls the trigger.*

FRANK VINICOR, DIRECTOR, DIVISION OF DIABETES TRANSLATION, U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION

CONDITION BACKGROUND AND DESCRIPTION

Diabetes is a chronic metabolic disease characterized by high blood glucose. The pancreas does not produce enough insulin, or alternatively, the body cannot effectively use the insulin it produces. Simply put, insulin is a hormone that regulates blood glucose. Insulin also maintains an increase in protein synthesis, glucose uptake, triglyceride synthesis, gluconeogenesis, the release of free fatty acids, and glycerol. Hyperglycemia, or raised blood glucose, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body’s systems, especially the nerves and blood vessels.¹

According to the World Health Organization (WHO), there are three distinct types of diabetes: Type 1, type 2, and Gestational. **Type 1 diabetes** develops when the body’s immune system destroys pancreatic beta cells, the only cells in the body that make the hormone insulin, which regulates blood glucose. **Type 2 diabetes** begins as insulin resistance, a disorder in which the cells are not able to use insulin properly. As the need for insulin rises, the pancreas gradually loses its ability to produce it. **Gestational diabetes** is a form of glucose intolerance diagnosed in some women during pregnancy.² A fourth type, not recognized by WHO, has recently been identified. **Latent autoimmune diabetes of the adult**, or LADA, is considered type 1.⁵ See Table 1 for more information about different types of diabetes.
Intermediate conditions that can occur in the transition between normality and diabetes are Impaired Glucose Tolerance (IGT) and Impaired Fasting Glycemia (IFG). This metabolic syndrome is discussed in another CMAG book, CMR, and in Figure 1 (p.4). Insulin resistance is defined as a condition in which the body is not using insulin to decrease glucose and triglyceride levels, both of which are diagnostic indicators for CMR. Insulin resistance could be attributed to the individual’s lifestyle, such as diet and exercise, or genetic factors. CMR is a risk syndrome representing potentially preventable complications, such as diabetes from the progression of insulin resistance. Individuals with IGT or IFG are at high risk of progressing to type 2 diabetes, although this is not inevitable.

**Guidelines for Early Diagnosis of Type 2 Diabetes and Pre-Diabetic Conditions**

The following section describes strategies for early diagnosis of type 2 diabetes and pre-diabetic conditions through screening and identification of risk factors.

- Screening for type 2 diabetes should be considered in individuals older than 45 years of age with a body mass index (BMI) greater than 25 kg/m².
- Screening may be accomplished with a fasting glucose test. 100-125 mg/dl may indicate pre-diabetes or an impaired fasting glucose (IFG).⁷

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### Table 1

**Characteristics of Different Types of Diabetes**

<table>
<thead>
<tr>
<th>Diabetes Type</th>
<th>Age of Onset</th>
<th>Etiology⁴ (Twin studies indicate genetic risk: 90% Type 2, 54% Type 1)</th>
<th>Clinical</th>
<th>Insulin Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 Diabetes</td>
<td>Childhood but can be any age</td>
<td>Unknown etiology – possibly hereditary, autoimmune, or related to viral infections</td>
<td>Lack of insulin production</td>
<td>Immediately</td>
</tr>
<tr>
<td>Type 2 Diabetes</td>
<td>Adults usually older than 30 years of age⁶</td>
<td>Unknown etiology – possibly hereditary and/or lifestyle</td>
<td>Ineffective use of insulin</td>
<td>Within 10 years</td>
</tr>
<tr>
<td>Gestational</td>
<td>Pregnancy but may develop Type 2</td>
<td>Pregnancy</td>
<td>Hormones interfere with the action of insulin</td>
<td>Case specific but usually resolves with diet, exercise, and delivery</td>
</tr>
<tr>
<td>LADA</td>
<td>Adult</td>
<td>One antibody seen in Type 1⁵ – etiology as in Type 1</td>
<td>Slow progression of Type 1</td>
<td>Within 4 years</td>
</tr>
<tr>
<td>Insulin Resistance Syndrome</td>
<td>Adult</td>
<td>Unknown etiology – possibly hereditary and/or lifestyle</td>
<td>Pre-diabetes or Metabolic syndrome</td>
<td>None</td>
</tr>
</tbody>
</table>

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Notes

Table 1

**Etiology**: Twin studies indicate genetic risk: 90% Type 2, 54% Type 1

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- Screening may be accomplished with a fasting glucose test. 100-125 mg/dl may indicate pre-diabetes or an impaired fasting glucose (IFG).⁷
• Screening also can be done with a glucose tolerance test. 140-199 mg/dl may indicate pre-diabetes or an impaired glucose tolerance (IGT).

In addition to an IFG or IG, other risk factors include the following:

• Genetic predisposition or a family history of diabetes, usually in a first-degree relative

• Poor diet or malnutrition

• Age of 45 years or older

• Hypertension greater than or equal to 140/90 mm/Hg. Low activity level, lack of exercise, or habitually physically inactive

• Overweight, especially around the waist

• High-density lipoprotein cholesterol level less than 35 mg/dl and/or a triglyceride level greater than 250 mg/d

• Polycystic ovary syndrome

• History of vascular disease

• A history of gestational diabetes or having a baby weighing more than 9 pounds at birth

• Ethnic background is African American, Native American, Asian American, Hispanic American/Latino, or Pacific Islander

Individuals with IFG or IGT should be educated aggressively about the benefits of eating a balanced diet, exercise, and maintenance of appropriate body weight.

Complications of diabetes may be reduced through early diagnosis. Because individuals often are not diagnosed with diabetes until complications arise and approximately one-third may go completely undiagnosed, it is critical to follow the progression from normal glucose tolerance to IFG and IGT to diabetes.

A risk calculator is available at http://www.diabetes.org/diabetesphd/default.jsp. See the chapter on CMR for further details.
COMMONLY RECOGNIZED SIGNS AND SYMPTOMS

Common signs and symptoms for both type 1 and type 2 diabetes include:

- Excessive excretion of urine (polyuria)
- Excessive thirst (polydipsia)
- Constant hunger (polyphagia)
- Weight loss
- Vision changes
- Fatigue

Additionally type 2 diabetics commonly suffer from:

- Blurred vision
- Dry mouth
- Dry or itchy skin
- Impotence in males
- Recurrent infections
- Sores that do not heal
Often symptoms for type 1 diabetes occur suddenly. Screening for type 1 diabetes is infrequent, and since the incidence is relatively low, more frequent screening is not considered cost effective. There may be testing for auto-antibodies if there are first-degree relatives with Type 1.

Many type 2 diabetics do not suffer any symptoms or the symptoms occur more insidiously over time. A random blood glucose level greater than 200 mg/dL may indicate a need for further testing.

In type 1 diabetes symptoms may include excessive excretion of urine (polyuria), thirst (polydipsia), constant hunger (polyphagia), weight loss, vision changes, and fatigue. These symptoms may occur suddenly. Routine screening is rarely done. There may be testing for auto-antibodies if there are first-degree relatives with diabetes. Since the incidence is low for type 1 diabetes, it is not cost effective to screen all children.

In type 2 diabetes, the onset is gradual, usually after the age of 30\(^1\) and may include symptoms such as polyphagia, polydipsia, polyuria, unexplained weight loss, fatigue, blurred vision, dry mouth, dry or itchy skin, impotence in males, recurrent infections, and sores that do not heal. Many individuals, however, do not experience symptoms. In addition, a random blood glucose level greater than 200 mg/dL may indicate a need for further testing.

**DIAGNOSIS**

Diagnosis of diabetes must meet the following criteria as outlined in the position paper by the American Diabetes Association (ADA)\(^6\) as the following:

1. Symptoms of diabetes plus casual plasma glucose concentration greater than 200 mg/dl
   - Casual is defined as any time of day without regard to time since last meal.
   - Classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss.
   —OR—

2. Fasting blood glucose of 126 mg/dl or higher
   - Fasting is defined as no caloric intake for at least 8 hours and most often nothing to eat after midnight.
   - Normal individuals have fasting sugar levels that generally run between 70-110 mg/dl.
   - 100-125 mg/dl may indicate pre-diabetes or IFG.
   —OR—
3. An oral glucose tolerance test greater than 200 mg/dl and confirmed by a test on another day.
- An initial blood glucose is drawn for a baseline.
- A high (75 grams) glucose drink is consumed by the individual.
- Blood is tested again at 30 minutes, 1 hour, 2 hours, and 3 hours after drinking the high glucose drink.
- This is considered a 2-hour post-load glucose tolerance test.
- The individual will fast for 10 hours but no more than 16 hours before the test.
- No smoking or drinking coffee the morning of the test
- No illnesses, not even a cold
- During the test, the individual must lie or sit quietly.
- Research has shown this is more effective in diagnosing diabetes; however it is also less convenient and should not be used on a regular clinical basis.
- Normal individuals should have a result of 139 mg/dl or lower.
- 140-199 mg/dl may indicate pre-diabetes or IGT.

4. A woman has gestational diabetes when she is pregnant and has any two of the following:
- Fasting plasma glucose of more than 105 mg/dl
- 1-hour glucose level of more than 190 mg/dl
- 2-hour glucose level of more than 165 mg/dl
- 3-hour glucose level of more than 145 mg/dl

PREVALENCE AND DESCRIPTION OF AT-RISK POPULATION

Diabetes Facts and Statistics\textsuperscript{17, 18, 19}

1. According to the ADA and the Centers for Disease Control and Prevention (CDC), 20.8 million children and adults — 7.0% of the population — have diabetes.
- 14.6 million individuals are diagnosed.
- 6.2 million individuals are thought to be undiagnosed.
- 54 million individuals are thought to have a pre-diabetes syndrome.

2. The World Health Organization (WHO) estimates that more than 180 million people worldwide have diabetes. This number is predicted to more than double by 2030. In 2005, an estimated 1.1 million people died from diabetes.
• Almost 80% of diabetes deaths occur in low- and middle-income countries.
• Almost half of diabetes deaths occur in people under the age of 70 years; 55% of diabetes deaths are in women.
• Diabetes deaths are projected to increase by over 80% in upper-middle income countries between 2006 and 2015.
• Type 1 diabetes accounts for 5-10% of all diagnosed cases of diabetes.
• Type 2 diabetes accounts for about 90-95% of all diagnosed cases of diabetes.
• African Americans, Hispanic/Latino Americans, American Indians, and some Asian Americans, Native Hawaiians, or Other Pacific Islanders are at particularly high risk for type 2 diabetes and its complications.
• Gestational diabetes occurs more frequently among African Americans, Hispanic/Latino Americans, and American Indians. After pregnancy, 5-10% of women with gestational diabetes are found to have type 2 diabetes. Women who have had gestational diabetes have a 20-50% chance of developing diabetes in the next 5–10 years.

COMPLICATIONS
Diabetes is associated with many potentially fatal complications. Good diabetes management can help reduce an individual’s risk. Working in a collaborative team approach with healthcare professionals, the individual with diabetes has the potential of reducing the number and severity of complications. However, many are not even aware that they have diabetes until they develop one of its complications. According to the ADA, the following are the complications most often associated with diabetes:

Heart Disease and Stroke
• Approximately 75% of deaths in individuals with diabetes were related to cardiovascular disease. The American Heart Association claims “diabetes is a cardiovascular disease.”
• Stroke and heart disease rates are two to four times higher in adults with diabetes than in adults without the condition.

High Blood Pressure
• About 73% of adults with diabetes have blood pressure greater than 130/80 or use prescription medications for hypertension.

Blindness
• Diabetic retinopathy causes 12,000 to 24,000 new cases of blindness annually.
Kidney Disease

- Diabetes is the leading cause of kidney failure, accounting for 44% of new cases in 2002.
- In 2002, 44,400 individuals with diabetes began treatment for end-stage renal disease (ESRD).
- In 2002, a total of 153,730 individuals with ESRD due to diabetes were living on chronic dialysis or with a kidney transplant.

Nervous System Disease

- About 60-70% of adults with diabetes have mild to severe forms of nervous system damage.
- Almost 30% of those 40 years or older have impaired sensation in the feet.
- Severe forms of diabetic nerve disease are a major contributing cause of lower-extremity amputations.

Amputations

- More than 60% of nontraumatic lower-limb amputations are attributed to diabetes.

Dental Disease

- Young adults have two times the risk of developing periodontal (gum) disease.
- Almost one-third have severe periodontal disease with loss of attachment of the gums to the teeth measuring 5 millimeters or more.

Complications of Pregnancy

- Poorly controlled diabetes before conception and during the first trimester of pregnancy can cause major birth defects in 5-10% of pregnancies and spontaneous abortions in 15-20% of pregnancies.
- Poorly controlled diabetes during the second and third trimesters of pregnancy can result in excessively large babies, posing a risk to both mother and child.

Sexual Dysfunction

- Erectile dysfunction is found in two times as many men with diabetes as in those without diabetes.
- Women with type 1 diabetes are twice as likely to experience prevalence of sexual dysfunction compared with women without diabetes.

Other Complications

- Uncontrolled diabetes often leads to biochemical imbalances that can cause acute life-threatening events, such as diabetic ketoacidosis and hyperosmolar (nonketotic) coma.
ECONOMIC IMPACT OF DIABETES

The following section identifies key economic costs associated with diabetes.

1. According to the CDC, the total annual economic cost of diabetes in 2002 was estimated to be $132 billion.24

2. In 2007, the cost for diabetes and its complications is estimated to be between $215 billion and $375 billion worldwide.25

3. The International Diabetes Federation predicts that by 2025, almost 80% of all diabetes cases will be in low- and middle-income countries.26

4. In the United States, acute hospitalization consumes 44% of diabetes-attributable costs, followed by:
   - 22% for outpatient care
   - 19% for drugs and supplies
   - 15% for nursing care27

5. In 2006, a new report entitled the State of Diabetes Complications in America adjusted costs to reflect inflation. This report estimated that $22.9 billion is spent on direct medical costs related only to diabetes complications.28

6. Annual healthcare costs for an individual with type 2 diabetes complications are about three times that of the average American without diagnosed diabetes. These complications cost almost $10,000 per person each year.29

7. Individuals with diabetes complications pay nearly $1,600 out of their own pockets for costs that are not reimbursed by insurance.30

PREVALENT TREATMENT MODALITIES

Type 2 diabetes is largely preventable through diet, weight loss, and exercise. As discussed in the section entitled “Guidelines for Early Diagnosis of Type 2 Diabetes and Pre-Diabetic Conditions and in Figure 1, pre-diabetes has become known through IFG and IGT testing. Furthermore, insulin resistance may not develop into diabetes. However, without lifestyle changes, the likelihood of developing diabetes increases. Studies have shown that individuals who change their lifestyle to include exercise, diet, and weight loss can prevent the conversion to diabetes and may even regain normal levels of glucose in their blood.31

Two such studies identified in the literature are the Finnish Diabetes Prevention Study and the Diabetes Prevention Programs. Both of these studies provided conclusive evidence that type 2 diabetes could be prevented.
or delayed with modest lifestyle changes. In the Finnish studies, therapeutic lifestyle change (TLC) interventions showed a 58% reduction in the development of diabetes. In the Diabetes Prevention Program, a 5-7% loss of body weight and 150 min/week of physical activity proved to be more effective than medications in preventing the onset of type 2 diabetes. Table 2 provides additional information about these studies.

### Table 2
**Specific Outcome Goals and Short-Term Behavior Targets of Diabetes prevention RCTs**

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Specific outcome goals</th>
<th>Short-term behavior targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Da Qing Impaired Glucose Tolerance and Diabetes Study</td>
<td>Six-year intervention; nine group sessions in first year, four per year thereafter</td>
<td>BMI &lt;=23 kg per m²; increase physical activity by at least one to two units per day</td>
<td>Use exchange diet with individually set goals for calories and for daily quantities of cereals, vegetables, meats, milk, and oils; use individually chosen physical activities selected from a list of suggested activities.</td>
</tr>
<tr>
<td>Finnish Diabetes Prevention Study</td>
<td>Three-year intervention; seven individual sessions in first year, four per year thereafter</td>
<td>BMI &lt;=25 kg per m²; 5 to 10 kg (11 to 22 lb) weight loss was common intermediary goal; increase physical activity</td>
<td>Use exchange diet in which daily calories comprise &gt;50 percent carbohydrates; &lt;10 percent saturated fat and &lt;20 percent other fat; &lt;300 mg cholesterol; 15g per 1,000 kcal of fiber; and 1g protein per kg for ideal weight. Use stepped approach: initial focus on food proportions; if no weight loss, then food amounts tracked; if no loss, then use very low-calorie-diet option.</td>
</tr>
<tr>
<td>Diabetes Prevention Program</td>
<td>Three-year intervention; minimum of 20 individual sessions in first year, six per year thereafter, plus other types of contact</td>
<td>7 percent weight loss, more encouraged if goal is achieved; at least 150 minutes of physical activity per week</td>
<td>Stepped approach, starting with self-monitoring of foods eaten, then fats, then calories (if needed), then options (if needed); phased-in physical activity and lifestyle activities.</td>
</tr>
</tbody>
</table>

*RCT = randomized controlled trial; BMI = body mass index.*

If individuals with pre-diabetes choose not to change their lifestyles, there is an increased likelihood that their blood glucose will rise to diabetes levels. Those individuals would then require treatment and management of the disease process to prevent complications. Management of diabetes is not only medication oriented, even though those treatments will be discussed at length. Lifestyle changes make up a large portion of diabetes management.
According to the American Association of Diabetes Educators (AADE), there are “7 Self-Care Behaviors,” also known as the AADE7, for diabetes management. They are listed below.

1. Healthy eating
2. Being active
3. Monitoring of blood glucose levels
4. Taking medications
5. Problem solving
6. Healthy coping
7. Reducing risks

Each of these behaviors is explained in more detail below. They are important because they give individuals with diabetes the opportunity to manage their own disease process and reduce the risk of complications. The healthcare professional may work with the individual to identify his or her level of readiness for change on the Stages of Change Continuum; this information will identify the individual’s motivation for change. More information on the transtheoretical model of change by DiClemente and Prochaska may be found in CMAG-2, Chapter 5.

**Healthy Eating**

Medical nutrition therapy is the cornerstone of treatment for healthy eating. Making healthy food choices based on carbohydrate counting and fat control, reading labels, planning and preparing meals, and learning about the effect of food on blood glucose are the focus points for the individual with diabetes. A diabetes educator or dietician/nutritionist is a great collaborative partner for this teaching.

According to the ADA, losing one pound a week may lower blood glucose and help the individual feel better. Eating smaller portions more often, switching to high fiber foods such as fruits and vegetables, and counting carbohydrates also are important. See Figure 2 for more information.
Tips for Healthy Eating Habits

- Trade a high-fat food for a low-fat choice each week.
- Make your meal look bigger. Serve it on a salad or dessert plate. One serving of meat is about the size of a deck of cards, bread is one slice, and pasta is the size of an ice-cream scoop.
- Package half of your restaurant meal “to go” before you start eating.
- Curb your hunger by drinking a glass of water 10 minutes before each meal.
- Still hungry right after a meal? Wait 20 minutes. It takes that long for your brain to know your stomach is full.
- People tend to eat more in front of the TV. Turn off the set.

Additional Resources


Being Active

In the Finnish Diabetes Prevention Study, weight loss averaged 9.2 pounds at 1 year, 7.7 pounds after 2 years, and 4.6 pounds after 5 years; “moderate exercise,” such as brisk walking, for 30 min/day also was suggested. In the Finnish study, there was a direct relationship between adherence with the lifestyle intervention and the reduced incidence of diabetes.

For the individual with diabetes, exercise is a very important treatment choice because it improves glycemic control. Being active can also help improve body mass index, enhance weight loss, help control lipids and blood pressure, and reduce stress. Increasing activity can be as simple as vacuuming, parking farther from the door at the store, taking the stairs instead of the elevator, and washing windows. Records of activity need to be kept by the individual to show progress. Working out with a friend is a great way to stay on target. Drinking plenty of water, monitoring blood glucose levels, and checking feet after exercise are critical.
**Monitoring Blood Glucose Levels**

Self-monitoring blood glucose (SMBG) is an important process for the individual with diabetes. This self-administered check of blood glucose will give individuals objective information to help them make correct decisions about diet and activity levels, as well as for proper dosing of medication. If the individual is adherent to this process, it will improve the adherence to the medication plan.

SMBG may be accomplished by using a finger stick method to draw blood, which is read with a glucose monitoring meter. Tools for SMBG are shown in Figure 3. Regardless of which form of self-monitoring the individual with diabetes chooses, the important part is the consistency of the self-monitoring.

For additional information about SMBG tools and steps for use, go to http://www.fda.gov/diabetes/glucose.html.
The ADA suggests the following glucose levels for adults with diabetes:

- **Before meals:**
  - Plasma glucose (sugar): 90-130 mg/dL
- **After meals:**
  - Blood glucose (sugar)<180 mg/dL
  - Plasma glucose (sugar)<180 mg/dL

The ADA also suggests taking blood glucose levels at the following frequency:

- Type 1: at least 3 times daily
- Type 2: as needed to achieve goals, which is usually 1-2 times daily

**Hemoglobin A1c (A1c) as a Tool for Achieving Glycemic Control**

Hemoglobin A1c (A1c) is the measure of average blood glucose during the previous 2 to 3 months. The physician should be consulted as to how often the A1c blood should be drawn, in the physician's office, for evaluation. The ADA recommends that testing be done every 6 months or when issues of control or medication changes are present. 2006 HEDIS performance measurements recommend the A1c test at least two times a year for individuals with stable glycemic control who are meeting their treatment goals and quarterly for individuals whose therapy has changed or do not have glycemic control. Overall, the A1c is an indicator of how well treatment is working.

An international survey of 12,000 individuals named the SHARED survey was conducted and released in 2005. This survey, conducted via telephone and Internet to diabetes specialists, general practitioners, nurses, and individuals with type 1 and 2 diabetes, indicated that fewer than 50% of individuals with diabetes have heard of the A1c test, the most important indicator of long-term complications.

The ADA recommends achieving an A1c of below 7%. In the UK Prospective Diabetes Study, it was noted that reduction in A1c reduces retinopathy, nephropathy, and neuropathy.

Wagner et al reported in 2001 that with a sustained reduction in A1c level among adult diabetic patients, mean total health care costs were $685 to $950 less each year within 1 to 2 years of improvement. Therefore, not only does the reduction of the A1c produce a positive clinical outcome, it also produces a positive financial outcome.

---

**Notes**

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Table 3
Summary of Recommendations for Adults with Diabetes

<table>
<thead>
<tr>
<th>Glycemic control</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>A1C</td>
<td>&lt;7.0%*</td>
</tr>
<tr>
<td>Preprandial capillary plasma glucose</td>
<td>90–130 mg/dl (5.0–7.2 mmol/l)</td>
</tr>
<tr>
<td>Peak postprandial capillary plasma</td>
<td>&lt;180 mg/dl (&lt;10.0 mmol/l)</td>
</tr>
<tr>
<td>glucose</td>
<td></td>
</tr>
<tr>
<td>Blood pressure</td>
<td>&lt;130/80 mmHg</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Lipids†</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL</td>
<td>&lt;100 mg/dl (&lt;2.6 mmol/l)</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>&lt;150 mg/dl (&lt;1.7 mmol/l)</td>
</tr>
<tr>
<td>HDL</td>
<td>&gt;40 mg/dl (&gt;1.1 mmol/l)</td>
</tr>
</tbody>
</table>

Factors for Consideration when Setting Glycemic Goals

- A1C is the primary target for glycemic control.
- Goals should be individualized.
- Certain populations (children, pregnant women, and the elderly) require special considerations.
- More stringent glycemic goals (i.e., a normal A1C, <6%) may further reduce complications at the cost of increased risk of hypoglycemia.
- Less intensive glycemic goals may be indicated in patients with severe or frequent hypoglycemia.
- Postprandial glucose may be targeted if A1C goals are not met despite reaching preprandial glucose goals.

* Referenced to a nondiabetic range of 4.0–6.0% using a DCCT-based assay.
† Postprandial glucose measurements should be made 1–2 hours after the beginning of the meal, generally peak levels in patients with diabetes.
‡ Current NCEP/ATP III guidelines suggest that in patients with triglycerides 200 mg/dl, the “non-HDL cholesterol” (total cholesterol minus HDL), be utilized. The goal is 130 mg/dl (34).

Urine Testing

Ketone testing is a urine test that is used in type 1 diabetes. High levels of ketones may result in a serious condition called ketoacidosis. Ketoacidosis is when acids called ketones build up in the blood. Illness, missing meals, or an insulin reaction could be the cause of ketoacidosis, which could result in a coma or even death.

The following are signs of ketoacidosis:

- Thirst or a very dry mouth
- Frequent urination
- High blood glucose levels
- High levels of ketones in the urine
These are followed by other symptoms:

- Constantly feeling tired
- Dry or flushed skin
- Nausea, vomiting over 2 hours or abdominal pain
- Short, deep breaths
- Fruity odor on breath
- Confusion

Ketone testing is usually done at the following times:\textsuperscript{56}

- When the blood glucose is higher than 240 mg/dL
- During acute illness (for example, pneumonia, heart attack, or stroke)
- When nausea or vomiting occur
- During pregnancy

To avoid complications, the Joslin Diabetes Centers recommends six tests, which are identified on Figure 4. While promoting self-efficacy, it is also important to give individuals with diabetes information that will help them manage their disease. Armed with the knowledge of these six tests may make the difference between complications or disease management.

<table>
<thead>
<tr>
<th>Figure 4</th>
<th>Tests for Managing Diabetes\textsuperscript{57}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A1C Test</td>
</tr>
<tr>
<td></td>
<td>Check 2-4 times annually</td>
</tr>
<tr>
<td></td>
<td>Blood Pressure Test</td>
</tr>
<tr>
<td></td>
<td>Check at least 2 times annually</td>
</tr>
<tr>
<td></td>
<td>Lipids Test</td>
</tr>
<tr>
<td></td>
<td>Check at least annually</td>
</tr>
<tr>
<td></td>
<td>Urinary Microalbumin</td>
</tr>
<tr>
<td></td>
<td>Check at least annually</td>
</tr>
<tr>
<td></td>
<td>Eye Exam</td>
</tr>
<tr>
<td></td>
<td>Check at least annually</td>
</tr>
<tr>
<td></td>
<td>Foot Exam</td>
</tr>
<tr>
<td></td>
<td>Check at least annually</td>
</tr>
</tbody>
</table>

Taking Medications

Multiple medications may be used for treatment of diabetes. Figure 5 illustrates treatment options for adults diagnosed with diabetes. If the patient has been unsuccessful in lifestyle changes (exercise and nutrition), the only remaining treatment is medications. Nonadherence to the medication treatment plan undermines the last line of defense against progression of diabetes and its associated complications. This is why medication adherence is critical for individuals with diabetes. Nonetheless, \textit{between 20 and 60\% of individuals with diabetes are nonadherent to their medication treatment plans}.\textsuperscript{58}
Insulin Therapy for Type 1 Diabetes

In individuals with type 1 diabetes, beta cell function is diminished, and the pancreas does not produce insulin. These individuals require insulin injections for glycemic control. The goal of insulin therapy for individuals with Type 1 is to mimic normal physiologic insulin secretion. This is done by utilizing an intensive insulin regimen consisting of basal background and mealtime (prandial) insulin (see Figure 6).
Insulin regimens should be designed around the individual’s meals, exercise, and lifestyle. Insulin cannot be taken orally because it would be destroyed by acids and enzymes in the digestive tract. Therefore, insulin is given by alternative methods, such as injection or inhalation. Insulin therapy also can be given through a continuous insulin infusion or an insulin pump. Refer to Table 4 for current insulin preparations.
### Table 4
**Current Insulin Preparations**

<table>
<thead>
<tr>
<th>Therapeutic Class</th>
<th>Trade Name</th>
<th>Action and expected outcome</th>
<th>When (with or without meals)</th>
<th>Onset Peak Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid acting insulin: Insulin Glulisine, Insulin Lispro, Insulin Aspart - analogs</td>
<td>Apidra®, Humalog®, Novolog®</td>
<td>Replenishes insulin Used for mealtime (prandial) coverage</td>
<td>Given immediately or 15 minutes before a meal. Can be dosed after meal if needed.</td>
<td>Onset 30 min, peak 1-3 hrs, duration 3-5 hrs</td>
</tr>
<tr>
<td>Inhaled insulin</td>
<td>Exubera®</td>
<td>Replenishes insulin Use for mealtime (prandial) coverage</td>
<td>Given within 10 minutes before the start of a meal (Exubera PI)</td>
<td>Onset less than 10-30 min, peak .5-3 hrs, duration 6 hrs</td>
</tr>
<tr>
<td>Regular insulin—human</td>
<td>Humulin R®, Novolin R®</td>
<td>Replenishes insulin Used for mealtime (prandial) coverage</td>
<td>Given 30 minutes before a meal</td>
<td>Onset .5-1hr, peak 2-3 hrs, duration 3-6 hrs</td>
</tr>
<tr>
<td>Intermediate acting insulin - NPH – human</td>
<td>Humulin N®, Novolin N®</td>
<td>Replenishes insulin Use for background (basal) coverage</td>
<td>Often used in combination with regular insulin Usually dosed BID.</td>
<td>Onset 2-4hrs, peak 4-10 hrs, duration 10-16 hrs</td>
</tr>
<tr>
<td>Long-acting insulin—glargine – analog</td>
<td>Lantus®</td>
<td>Replenishes insulin Use for background (basal) coverage</td>
<td>Dosed once daily</td>
<td>Onset 2-4 hrs, peakless, duration 20-24 hrs</td>
</tr>
<tr>
<td>Long-acting insulin-- detemir – analog</td>
<td>Levemir®</td>
<td>Replenishes insulin Use for background (basal) coverage</td>
<td>May be given once or twice-daily (Levemir PI)</td>
<td>Onset .8-2hrs, peak flat, duration up to 24 hrs</td>
</tr>
<tr>
<td>Mixtures</td>
<td>Humalog Mix 50/50®, Humulin 70/30®, Novolin 70/30®, Humalog Mix 75/25®, Novolog Mix 70/30®</td>
<td>Replenishes insulin</td>
<td>Varies with mixture</td>
<td>Varies with mixture</td>
</tr>
</tbody>
</table>
Medications for Type 2 Diabetes

Type 2 diabetes is a progressive disease characterized by a dual defect of insulin resistance and insulin deficiency. Combination therapy with combinations of oral agents and insulin has allowed treatment teams to work with individuals based on their lifestyles and reactions to treatment. Considerations for all drug therapy must be individualized based on weight, age, level of glycemic control, comorbidities, and disease severity. Combination therapy allows for tailor-made programs for individuals with diabetes. Medication adherence must be assessed as complexity rises in treatment options, number of medications, and lifestyle changes.

With type 2 diabetes, it is extremely important that the individual be educated and empowered regarding all aspects of glycemic control. The signs and symptoms of hypoglycemia, diet changes, mealtime changes, exercise changes, and other lifestyle circumstances must be understood as they relate to the medications. As medications are adjusted with progression of the disease, the individual with diabetes must be prepared for change and adapt accordingly to every aspect of care. Medication adjustment affects diet, exercise, and lifestyle, just as these areas affect medication adjustment. In individuals with type 2 diabetes, beta cell function declines over time, and individuals may require insulin therapy. Nathan et al, along with the ADA, supports the insulin algorithm (Figure 7) for the progression of the use of insulin.60
Initiation and adjustment of insulin regimens. Insulin regimens should be designed taking lifestyle and meal schedule into account. The algorithm can only provide basic guidelines for initiation and adjustment of insulin. *Premixed insulins are not recommended during adjustment of doses; however, they can be used conveniently, usually before breakfast and/or dinner if proportion of rapid- and intermediate-acting insulins is similar to the fixed proportions available. bg, blood glucose.
There are many barriers to starting insulin therapy, both for the individual with diabetes and for the prescriber. Discussing insulin early on and teaching about the progressive nature of the disease can help. Physicians and the collaborative team should introduce the possible need for insulin early in treatment and refrain from speaking about possible future use of insulin as though it were a threatened punishment for poor compliance. Instead, the treatment team should help individuals with diabetes see insulin as a powerful tool to assist in lowering blood sugar, managing diabetes, and preventing complications.62

According to Meece, the following barriers to insulin therapy were defined by the American Association of Diabetes Educators at their August 2005 annual meeting:63

- Resistance and fear
- Needles and injections equated with pain
- Complications such as amputations and kidney failure
- Weight gain
- Inconvenience
- Physician resistance
- More time-consuming
- Inadequate support/resources
- Lack of updated information
- Cost

Oral medications for managing type 2 diabetes control glucose levels in different ways. Sulfonylureas and meglitinides or secretogogues stimulate the pancreas to release insulin. Oral sensitizers such as the biguanides (metformin) and TZD’s make muscle cells more sensitive to insulin. Alpha-glucosidase inhibitors work in the intestine by slowing the digestion of carbohydrate. The newest agents include DPP-IV inhibitors, GLP-1 analogs, and pramlintide. DPP-IV inhibitors enhance beta cells to improve glucose uptake and decrease glucose production. GLP-1 analogs are the class of drugs known as incretin mimetics, which enhance glucose dependent secretion, and symlin, an injectable analog of the hormone amylin.

**Medications Used for Glycemic Control**

The oral medications in Table 5 may be used as monotherapy or in combination, dependent upon glycemic control.
<table>
<thead>
<tr>
<th>Therapeutic Class</th>
<th>Trade Name</th>
<th>Site of action</th>
<th>When (with or without meals)</th>
<th>Important to Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfonylureas 2nd generation - Insulin Secretagogues</td>
<td>Amaryl®</td>
<td>Pancreas</td>
<td>First main meal of the day – 30 minutes before</td>
<td>May cause hypoglycemia</td>
</tr>
<tr>
<td></td>
<td>Glucotrol®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glucotrol XL®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meglitinides – non sulfonylureas - Insulin Secretagogues</td>
<td>Starlix®</td>
<td>Pancreas</td>
<td>Take with meals to combat post-meal blood sugar spikes</td>
<td>Shorter duration of action than sulfonylureas</td>
</tr>
<tr>
<td></td>
<td>Prandin®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biguanides</td>
<td>Metformin®</td>
<td>Liver</td>
<td>Take with meals</td>
<td>Slow titration may help prevent nausea and diarrhea.</td>
</tr>
<tr>
<td>Thiazolidinediones (TZDs)</td>
<td>Avandia®</td>
<td>Muscle cells</td>
<td>Take with or without food</td>
<td>May cause fluid retention and weight gain. Takes 4-6 weeks to show effect on blood glucose.</td>
</tr>
<tr>
<td></td>
<td>Actos®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alpha-Glucosidase Inhibitors</td>
<td>Precose®</td>
<td>Intestine</td>
<td>Prevent surges of glucose after a meal</td>
<td>May cause diarrhea</td>
</tr>
<tr>
<td></td>
<td>Glyset®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Combinations</td>
<td>Glucovance®</td>
<td>Mixed</td>
<td>Varies with mixture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avandamet®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metaglip®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Actoplus met®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avandaryl®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exenatide- Incretin Mimetic</td>
<td>Byetta®</td>
<td>GI tract</td>
<td>Injection before meals twice daily</td>
<td>May cause nausea</td>
</tr>
<tr>
<td>Pramlinitide – non-insulin synthetic analog</td>
<td>Symlin®</td>
<td>Pancreas</td>
<td>1-4 injections per day with meals</td>
<td>Used in individuals on intensive insulin therapy. May cause nausea</td>
</tr>
<tr>
<td>Sitagliptin - DPP-IV Inhibitors</td>
<td>Januvia®</td>
<td>Pancreas</td>
<td>Can be taken without food</td>
<td>Should not be used in individuals with Type 1</td>
</tr>
</tbody>
</table>
Barriers to oral medication adherence may be perceived or related to side effects of the medication or the disease process. Assessment of the individual’s knowledge of the medication and motivation to take the medication is a critical step in promotion of adherence. Following are possible barriers to adherence with oral glycemic control medications:

- Weight gain
- Time of day medication is to be taken
- Medication taken with or without meals. Timing critical here as well.
- Hypoglycemic event experience or fear
- Gastrointestinal side effects interfering with lifestyle
- Other medication interaction potential
- Oral agents may also be combined with insulin
- Cost of medications
- Availability and coverage of medications through health plan

**Problem Solving**

Since diabetes is a disease process, which may change from day to day due to changes in lifestyle, other illnesses, and/or medications, it is critical that the individual with diabetes be prepared to make adjustments and problem solve rapidly. An example of this would be when a hypoglycemic event occurs. The individual or family must be aware of the signs and symptoms immediately and start problem solving right away to resolve the event. Such symptoms might include:

- Dizziness or shakiness
- Nervousness
- Rapid heartbeat
- Trouble concentrating
- Headache
- Irritability, moodiness, or anger
- Sweating
- Tingling in the face or lips
- Extreme hunger
Healthy Coping

Diabetes is a complex disease requiring individuals to make many changes, which may challenge their established coping mechanisms. Lifestyle changes are not easy and if the individual is not motivated to make these changes they will not occur. Diabetes is demanding and pervasive, requiring attention during every waking moment. It is critical that the individual understand, demonstrate, and integrate the knowledge and skills necessary for self-care.

Reducing Risks

According to the ADA, every percentage point drop in A1c blood test results (e.g., from 8.0% to 7.0%) reduces the risk of microvascular complications (eye, kidney, and nerve diseases) by 40%. In addition, simple self-care knowledge and assessment, such as foot care to prevent amputations, regular eye examinations to prevent blindness, exercise with proper diet, and checking blood pressure to reduce the complication of cardiovascular disease, also may reduce risks.

Monitoring and recording of assessments is an important piece of teaching to the individual with diabetes. Motivation of individuals to actively participate in their own care is dependent upon their readiness to change, which will be discussed in a later chapter. In Table 6 from the AADE, percentage of preventable complications is noted.

<table>
<thead>
<tr>
<th>Potential Complications</th>
<th>Percentage of Preventable Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney failure</td>
<td>50% (with better control of blood pressure and blood glucose levels)</td>
</tr>
<tr>
<td>Blindness</td>
<td>up to 90% (with proper screening and care)</td>
</tr>
<tr>
<td>Amputation</td>
<td>up to 85% (with implementation of foot care programs that include regular examinations and patient education)</td>
</tr>
<tr>
<td>Death due to heart disease or stroke</td>
<td>up to 30% (with improved control of blood pressure, blood glucose, and lipid levels)</td>
</tr>
<tr>
<td>Heart disease and stroke</td>
<td>up to 50% (with improved control of blood pressure and cholesterol and lipid levels)</td>
</tr>
<tr>
<td>Nerve disease</td>
<td>40% (with a 1% reduction in hemoglobin A1c test)</td>
</tr>
</tbody>
</table>
ADHERENCE CHALLENGES

Throughout the case management process, the treatment team must identify factors that could present challenges to the individual with diabetes to help that person be adherent to medication and other treatment options. Factors such as population issues, cultural diversity, age-related characteristics, and comorbidities should be considered whenever the treatment team and the individual discuss and assess adherence. In addition, the complexity of the disease process itself, the treatment for the disease, and lifestyle changes required create more compounding challenges to adherence.

Figure 8
Estimated Total Prevalence of Diabetes in People 20 Years or Older in the United States

Estimated total prevalence of diabetes in people aged 20 years or older, by age group — United States, 2005

Source: 1999-2002 National Health and Nutrition Examination Survey estimates of total prevalence (both diagnosed and undiagnosed) were projected to year 2005.

Population: Age

Age is an exceptional challenge since diabetes education must be tailored for patients ranging from children to the elderly. The following sections identify issues directly related to the age of the individual with diabetes.
Adults Aged 20-59

As seen in Figure 8, 20.6 million Americans, or 9.6% of all people in this age group, have diabetes. Individuals between the ages of 40 and 59 make up the largest number for newly diagnosed people with diabetes, as shown on Figure 9.

Figure 9
Number of New Cases of People Diagnosed with Diabetes Ages 20 years or Older—United States, 2002

Number of new cases of diagnosed diabetes in people aged 20 years or older, by age group — United States, 2002


Adults between 20 and 59 are often active, working, busy, involved with family issues such as children or aging parents, and have lifestyles that may include dining away from the home, travel, and formal exercise programs. A good assessment, with open-ended questions, will help elicit lifestyle issues while identifying barriers, such as fear of embarrassment, challenges with weight, and general management of multiple medications. In order for education to be meaningful, it must be tailored to the lifestyle appropriate for the individual.
According to the 2006 Pew Internet and American Life Project, the age of adults found to use the internet are as follows:  
- Age 18-29 – 88%
- Age 30-49 – 84%
- Age 50-64 – 71%
- Age 65+ – 32%

According to the May 2005 Pew Internet report, eight in ten Internet users look for information on health topics. It is highly likely that adults aged 20-59 will use the Internet to find health information. Therefore it is critical to help individuals with diabetes in these age groups find resources that are meaningful to them and are reputable healthcare Web sites.

**Adults Over Age 60**

As shown in Figure 8, 10.3 million Americans, or 20.6% of all people in this age group, have diabetes. Individuals over the age of 60 are more likely to live alone and take multiple medications for multiple medical conditions. The complexity of the management of diabetes, potential depression, and cognitive impairment could create challenges to improving adherence. In the Federal Study of Adherence to Medications in the Elderly (FAME), it was shown that patient education and custom blister-packed medications as part of a comprehensive pharmacy program improved adherence with the high-risk elderly.

According to the National Institute on Aging, there are specific tools (those in bold) for older individual in managing their diabetes and maintaining adherence.

1. **Meal planning and eating correctly**
   - Meal planning should be portioned correctly. Adults in this age range frequently eat alone but previously made meals for an entire family.
   - Snacking with healthy foods should be considered.

2. **Physical activity**
   - Inactivity is often an issue. It is important to explore a variety of means to increase physical activity, such as household chores. Often individuals believe they must go to a gym to increase physical activity.

3. **Medications**
   - Often medications are complex in the individual with diabetes. To address the complexity, along with possible cognitive deficiencies, pillboxes, logging of medications, and timers are valuable tools. Fear of needles may also complicate medication adherence.
• Cost may also become a barrier since the older adult may be on a fixed income and must choose between medications and other necessities. Increasingly, retiree pension plans do not cover medications. Also the Medicare part D prescription coverage plans generally have very large out-of-pocket (deductibles and cost-shares) associated.

4. Keeping track

• Keeping track of all activity, food intake, and medications will help older individuals with diabetes gradually change their behavior. Blood glucose via self-monitoring as well as HbA1c lab values should be logged for progression of disease process and improved adherence with other changes needed to manage diabetes.

5. Eye exams every year

6. Kidney check via a yearly urine test for a protein called albumin

7. Foot care

8. Skin care

9. Care of teeth and gums

10. Flu shots and pneumonia vaccine annually

Older adults with diabetes living in long-term care settings also present challenges. Multiple system comorbidities can make medication choice decisions complicated; more than 80% have cardiovascular disease, 56% have hypertension, and 69% have two or more chronic conditions in addition to diabetes. If additional complications, such as impaired hearing, impaired vision, blindness, inactivity, inability to perform activities of daily living, and pain and depression, are present, diabetes management can be a further challenge. Additionally individuals in long-term care facilities generally have limited abilities or opportunities to participate in self-care. Frequently staff members have large numbers of patients to tend to, resulting in regimented care (timing of medication) and reduced flexibility.

Children and Adolescents

In 1997 there were 123,000 children and adolescents in the United States with diabetes. Much of the care of these children occurs in the schools. This makes it critical to educate the school staff working with children and adolescents along with the parents. A collaborative effort is needed between the child, the parent, school personnel, and healthcare providers to meet this challenge.
Population: Ethnicity.

Figure 10 shows the age-adjusted total prevalence of diabetes in adults by race and ethnicity. Ethnicity and culturally diverse individuals with diabetes present different challenges to medication adherence. The following section provides more specific information about the impact of diabetes on selected ethnic groups.

African American

According to the ADA, the statistics are as follows:

- Some 3.2 million, or 13.3%, of all African Americans aged 20 years or older have diabetes.
- African Americans are 1.8 times more likely to have diabetes than non-Hispanic whites.
- Twenty-five percent of African Americans between the ages of 65 and 74 have diabetes.
- One in four African American women over 55 years of age has diabetes.
The ADA’s African American Initiatives are working toward creating increased awareness about the impact and seriousness of diabetes for people of African descent. These initiatives provide educational tools and resources that enable individuals with diabetes to manage their disease more effectively and prevent or delay the onset of diabetes for those at risk. The initiatives also are establishing collaborations to more effectively reach the community while also building trust. Finally, the ADA is developing qualitative assessments that provide a true measure of existing programs and guide development of future programs while developing a plan to reach specific subgroups of older Americans and youth. All of these areas are challenges to adherence for the African American population.

**American Indian/Alaskan Native**

The prevalence of diabetes in the American Indian and Alaskan Native culture is reported as follows:

- 15.1% of adults have diabetes.
- Those under the age of 35 with diabetes increased by 133% between 1990 and 2001.
- The mortality rate is 4.3 times higher than that of the American population in general.

Advocacy for this culture regarding healthcare providers, medical coverage, dietary help, and increased awareness through education is critical to the improvement of adherence to diabetes treatment.

**Lifestyle Change**

In diabetes, barriers to adherence are not exclusive to medications. As prediabetes data become more prominent, lifestyle change will become a priority. It is important to remember that type 2 diabetes is essentially preventable if certain lifestyle changes are made before glycemic control is lost. Once the diagnosis of diabetes is made, multiple lifestyle changes (diet, exercise, monitoring blood sugar, preparation for hypoglycemic events) have to be made; as a result, adherence barriers could arise regardless of the age, ethnicity, or education of the individual.
In addition, there are many myths regarding diabetes that complicate adherence to lifestyle changes. Barriers are created when a myth is believed to be true. This makes the education process even more critical to reducing the barriers to diabetes management. Common myths include:

- You can catch diabetes from someone else.
- People with diabetes can’t eat sweets or chocolate.
- Eating too much sugar causes diabetes.
- People with diabetes should eat special diabetic foods.
- If you have diabetes, you should eat only small amounts of starchy foods, such as bread, potatoes, and pasta.
- People with diabetes are more likely to get colds and other illnesses.
- Insulin causes atherosclerosis (hardening of the arteries) and high blood pressure.
- Insulin causes weight gain, and because obesity is bad for you, insulin should not be taken.
- Fruit is a healthy food. Therefore, it is okay to eat as much fruit as you wish.
- You don’t need to change your diabetes regimen unless your A1C is greater than 8%.

Reimbursement/Cost of Care

The individual’s out-of-pocket expenses can become staggering when only part of the full cost is covered by third-party payers. For example, consider the costs associated with ongoing counseling with a diabetes educator or a nutritionist, visits to a specialized physician, and a wide variety of medications and supplies utilized daily for the management of the disease. It might also be noted that change in diet could present financial barriers to the individual with diabetes. Ultimately the healthcare system is challenged as the cost of care increases because of nonadherence.

Other Issues

Other barriers to adherence are due to social isolation, deficient knowledge of diabetes, minimizing the seriousness of the disease, opposition to change, and the modern medicine approach, which includes a complex treatment regimen, including lifestyle changes.
Even the modern medicine approach may become a barrier because the individual with pre-diabetes or newly diagnosed diabetes may feel that by taking a pill all will be resolved. Many have become reliant on this method of healthcare. It is important for patients with diabetes or pre-diabetes to understand that taking medication doesn’t “heal” the disease and doesn’t reduce the need for changes in lifestyle. It is not uncommon to hear an individual say, “I am on medication for that so I don’t have to follow a diet.” This represents a lack of knowledge on the part of the patient.

DISEASE SPECIFIC ADHERENCE ASSESSMENT

REALM-R

In CMAG the REALM-R is used to assess the health literacy of the individual. The 2003 National Assessment of Adult Literacy (NAAL) survey shows that 2 out of every 5 adult Americans have difficulty obtaining, processing, and understanding the basic health information and services needed to make appropriate health decisions.

In the case of diabetes, it is imperative that individuals with diabetes understand the disease process, from early insulin resistance to complications. During post-assessment with the REALM-R, the case manager may focus on the following:

- Assess patients knowledge of the disease, including progression and complications.
- Ask about safety issues, such as what to do when hypoglycemic.
- Assess if patients know how to obtain follow-up care with medical providers.
- Ask when lab tests, such as A1c, are due.
- Ask the protocol, rationale, and implications with SMBG.
- Ask for reasons for a balanced diet, exercise, and lifestyle change.
- Assess their medication knowledge.

As outlined by the Partnership for Clear Health Communication, the following may be true of individuals with low health literacy:

- Less likely to comply with prescribed treatment and self-care regimens
- Make more med or treatment errors
- Fail to seek preventive care
- Are at higher risk for hospitalization
- Remain in hospital nearly 2 days longer
- Lack the skills needed to navigate the healthcare system
As discussed earlier, the AADE notes that there are “7 Self-Care Behaviors” for diabetes management. Common questions to ask the individual with diabetes regarding these seven behaviors follow:

1. Healthy eating
   • Describe what you eat in a day’s time.
   • How do you meal plan when you travel or go out with friends?
   • Tell me about your food choices and your rationale.
   • Tell me about portion sizes. Are you tempted to eat seconds?
   • How is food/drink prepared? And by whom?

2. Being active
   • Tell me about the activity you receive in a day’s time.
   • Describe your activity plan.
   • Are there special precautions you take when exercising?
   • Does your activity ever change the dosage of your medication? If so, discuss.
   • Do you have a “buddy” to exercise or be active with? If so, tell me how this works.

3. Monitoring of blood glucose levels
   • Tell me about how you monitor and record your blood sugar.
   • Is it inconvenient to check your blood glucose at work or at school?
   • Explain what you do if the tested level changes.
   • When do you call the doctor?
   • What was your last A1c?

4. Taking medications
   • Talk with me about the medications you take.
   • Are there specific times or ways you take your medications? What are they?
   • Do you sometimes lose track of time at work or at school?
   • How do you feel about taking these medications?
   • After self-monitoring, tell me how you might adjust your medications.
   • When do you call the doctor?
   • What is your plan if complications of medications arise?
5. Problem solving
   • Describe how you are prepared to handle high or low blood sugar.
   • When is it time to seek medical treatment?
   • Tell me about your plan to assess your feet, eyes, and teeth.
   • Do you take your blood pressure? What do you do with this information? Do you know what to do if it is higher than what your doctor has discussed?

6. Healthy coping
   • In the past two weeks, have you been feeling consistently depressed or down?
   • Have you had difficulty with feeling sad or blue?
   • Has your mood interfered with your ability to take care of your diabetes?
   • How do you feel about having diabetes?
   • Whom do you talk to about diabetes?
   • Tell me about what makes you anxious and stressed. How do you manage stress?
   • Describe goals you have set for yourself regarding diabetes. (Remember this is a step-by-step process; pushing the individual with diabetes may not be effective and may actually add to the stress of disease management.)
   • What do you do when you have a bad day?

7. Reducing risks
   • Tell me what you know about the potential impact of diabetes on your life.
   • Do you smoke? If the answer is “yes,” follow up on motivation to stop.
   • Discuss ways to prevent these risks.
   • What is your follow-up schedule with the treatment team?

Medication Knowledge
The next assessment tool in the CMAG™ is the Medication Knowledge Survey. This can be quite a challenging process for the individual with diabetes. Diabetes management usually requires a very complex regimen, with many lifestyle changes, such as diet and exercise, that might affect dosages daily. There must be a balance between the real world situations and the ideal clinical circumstances that allow the individual or his or her caregiver to manage the diabetes. Some individuals will research and learn every aspect of the disease process, including medications they take. Conversely there are those who are passive in their management and understanding of the disease. The defining difference appears to be health literacy and motivation. Additionally it is not uncommon for an individual who “appears motivated and
knowledgeable” to have difficulty managing the disease and treatments prescribed. This may frustrate the treatment team as well as the patient. It is very important to discuss all aspects of care openly and repeat care issues at every possible opportunity.

In addition to the Medication Knowledge Survey, one question may be, “Have you missed any pills in the past week?” Any pills missed may signal a problem with medication adherence. In diabetes, this may be very simple but also very critical since complications arise rapidly.

If the individual with diabetes is a child or adolescent, it is important to ask the parent, school representative, or caregiver questions about medication. Each individual involved in care may have different answers and understanding. To reduce the stress for the child, it is important that the message is consistent.

**Readiness-to-Change Ruler**

Once a specific goal and the changes required to meet that goal are identified, the next step is to assess motivation to change using the readiness-to-change ruler. This simple tool is critical in assessing motivation to change lifestyle and maintain all aspects of diabetic care. Scripting for this would include, “If you were to rate your readiness to change (selected behavior) on a scale of 1-10, one being ‘not prepared’ and 10 being, ‘I’ve changed,’ what number would you pick?” See **CMAG-2** for follow-up questions, dependent upon the response given by the patient.

(Note: This could be simplified by asking about diet, activity, smoking cessation, or medication adherence.)

**Duke-UNC Functional Social Support Questionnaire (FSSQ)**

The final assessment tool in CMAG is the FSSQ. This is an eight-question form that assesses the individual with diabetes and the support he or she has to manage this complex disease. Since diabetes may affect multiple ages of individuals, from children to the elderly, support may mean different things to different individuals. The FSSQ is primarily focused on adults; however a non-formal assessment of the child or adolescent may be accomplished by asking questions similar to those below. Also, it is imperative that the family/caregiver of children with diabetes be assessed as well for their support issues.

Additional questions might include:

- Who helps you manage your diabetes?
- Who helps you with other aspects of your life?
- How do you ask for support for your diabetes or lifestyle changes?
Do you feel anyone is “too helpful?” What do you do to let them know how much help you need?

How do you tell your family and friends specific ways to help you follow your treatment plan?

Do you ever bring family or support individuals with you to meet your healthcare team?

Identify the healthcare team as a support system, too. Then ask, “Who is involved in your care? Are they supportive? Do they listen? Do they help you solve problems?” Discuss your trust level with the treatment team.

**Quadrant Assignment and Planning**

Once the individual with diabetes has been assessed and categorized as high or low knowledge and high or low motivation, the next step is to assign him or her a quadrant based on this categorization. Interventions and tools are available for individuals in these quadrants. The goal is to help the patient move into a higher level on the quadrant, which indicates improved adherence intention.

**Knowledge Tools**

The Internet has rapidly become the most popular place for individuals to learn about healthcare topics. While brochures in healthcare professionals’ offices may get the individual with diabetes started in thinking about what to do next, the Internet gives detail. It is important to note that the ability to read and understand materials is very important. Other issues to consider include the following:

- What is the preferred method of learning (e.g., lecture, reading, demonstration, or video)?

- Are there cultural influences that will affect the learning process? If so, it is important to identify obstacles to learning before teaching. A diabetes educator is one of the most valuable tools for anyone in any quadrant of CMAG.

Below are some Web sites, along with a description of some of the information they include, that individuals with diabetes may find useful.

1. [http://www.altoonafp.org/analogies.htm](http://www.altoonafp.org/analogies.htm)

   - HbA1c: the red blood cell is shaped like a doughnut; the HbA1c measures the amount of sugar stuck to the doughnut.

   - Insulin: Insulin is the key that opens the lock on the door so that sugar can get into the cells and be used. Sometimes the lock gets stuck and other medicines are needed to help free up the lock so that the door can open again. Alternatively, think of insulin as follows: Glucose is like cars on the freeway. The insulin opens up the off ramps so it can get out of the bloodstream and into the cells where the sugar is needed.
• Diabetes education: Diabetes education is like going to church. You don’t get it all the first time. You have to go back again and again. You’re always forgetting things and always learning something.

• Health maintenance: Taking care of your health is like doing maintenance on your car. You don’t wait until you blow your engine before you change the oil.

• Medication adherence: Taking medicines on a regular basis is like watering a garden. If you wait until the plants are a little wilted, it’s too late. Water every day.

   • Simple explanation to complex explanation of diagnosis
   • Books and magazines available
   • Recipes

   • Diabetes and Cardiovascular Disease Toolkit. The American Diabetes Association, together with the American College of Cardiology and the Preventive Cardiovascular Nurses Association, has developed a toolkit to educate their patients about cardiovascular diseases. The kit covers 26 topics, and it is available in English and Spanish. PDF formats can be downloaded and reproduced. A hard copy or a CD-ROM of the toolkit is available free for healthcare professionals and can be ordered by calling 1-800-Diabetes. Topics covered include pre-diabetes, getting the best care, care for type 2 diabetes, blood glucose, insulin resistance, and protecting a diabetic’s heart.

   • Learn about diabetes
   • Manage diabetes
   • Find help and support
   • Stay informed

   • Patient-friendly materials
   • Very inclusive of all aspects of the disease

7. http://www.askme3.org/— A perfect way to involve the patient with self-care and to engage the healthcare professional.
   • What is my main problem?
   • What do I need to do?
   • Why is it important for me to do this?

   • International Diabetes Association Awareness Web site
   • Current news on diabetes
   • Blog
   • Youth ambassadors
   • Advocacy kits

9. http://www.dlife.com/—This Web site is geared toward patients and their caregivers. It has a very wide range of information on medication, diagnosis, treatment, nutrition/lifestyle, and getting support. It is mainly geared toward education and helping individuals with diabetes and their loved ones understand and cope with the disease.

    • This Web site is useful to patients, caregivers, and practitioners. It talks about the importance of insulin, and offers inspiring stories of other patients on insulin. It also has a variety of helpful resources and a discussion guide for asking questions.
    • Questions to Ask Your Doctor
      —If my A1c level is higher than 7%, might insulin help?
      —Are my diabetes pills insufficient?
      —If I do go on insulin, will I have to adjust the dosage of my other medications?
      —Is it hard to inject insulin? How will I learn how to do it?
      —Would I have to test my blood sugar more often?
      —What types of insulin are there?
      —Would I take insulin alone or in combination with diabetes pills?
      —If I don’t like insulin can I stop taking it?
Motivational Tools

The following tips will help diabetes professionals work more effectively with their patients.

1. Communication
   • Repeat information, check the understanding (teach back), explore the patients’ own thoughts and the willingness to apply them.\(^9^8\)

2. Tailored care
   • Structured diabetes consultation model may be effective.\(^8^9\)

3. Shared care
   • Work in a multidisciplinary team.\(^8^9\)

4. Coping mechanisms
   • Do not blame as this will foster guilt and anxiety, especially in individuals with diabetes. This is a disease that causes embarrassment and may cause people to become overwhelmed.\(^8^9\)

5. Motivational Interviewing – Discussed at length in \textit{CMAG}-2. It is very effective in counseling individuals with diabetes toward behavior change.\(^9^9\)

6. Stages of Change – Lifestyle change assessment and intervention (Table 7).
# Table 7

## Stages of Lifestyle Change

<table>
<thead>
<tr>
<th>Stage</th>
<th>Behavior</th>
<th>Physician’s goal for visit (to move patient forward)</th>
<th>Tips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precontemplation</td>
<td>Not considering change</td>
<td>Move toward thinking about change</td>
<td>Get patient talking: “Have you ever considered this before?” “What would have to happen to get you to consider this?” Emphasize patient’s autonomy: “I’m concerned about your health…of course, this is entirely your decision…I can help when you are ready to change…”</td>
</tr>
<tr>
<td>Contemplation</td>
<td>Considering change</td>
<td>Move toward preparing for change</td>
<td>“How have your friends or family members made this change?” “Would you like a list of local programs?” “I have some new information comparing various approaches to weight loss.”</td>
</tr>
<tr>
<td>Preparation</td>
<td>Preparing for change (e.g., reading about diets, asking friends about gyms)</td>
<td>Move toward taking action</td>
<td>Praise preparation, discuss options, assist in setting initial goals and behavior targets, and set a start date.</td>
</tr>
<tr>
<td>Action</td>
<td>Establishing the change</td>
<td>Maintain change</td>
<td>Praise all efforts, limit suggestions for additional changes to one or two, and begin to anticipate obstacles.</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Struggling to maintain the gains</td>
<td>Maintain change</td>
<td>Praise all efforts, limit suggestions for additional changes to one or two, and help patient deal with obstacles.</td>
</tr>
<tr>
<td>Identification</td>
<td>Incorporating the change into routine and view of self (the new pattern is now automatic, there is little temptation to lapse)</td>
<td>Maintain change</td>
<td>Praise all efforts.</td>
</tr>
</tbody>
</table>

**NOTE:** Relapse—patients often slide backward through these stages, and most attempt major lifestyle changes numerous times before succeeding. Do not expect an uninterested patient to progress through all the stages in one office visit. Information from references 37 and 38.
7. Techniques to use at each session with the individual with diabetes

- Self-monitoring
  - Track all foods eaten and physical activity.
  - Gradually coach to monitor while changing what works for them.

- Homework follow-up
  - Countable behaviors of activity and calories.
  - Ask and praise at every visit.
  - Add tasks or suggestions if change is resulting from homework.

- Provide choices
  - Start simple but give choices, such as choosing between physical activity or weight loss through healthy eating.

- Empower patients
  - Use a coaching model to facilitate change.
  - Guide the individual with diabetes in developing skills of self-sufficiency and building confidence.

- Identify and overcome barriers
  - Ask about obstacles to diet and exercise plans.
  - Offer possible solutions, tips, or options.
  - Allow the individual with diabetes to pick a possible solution.
  - Maintain a trial-and-error approach
  - A slip is not a failure but an opportunity to learn what works and what does not work in overcoming particular barriers.

- Skill development. See Table 8 for more information on this topic.
### Table 8
**Skill Development** — Advanced Skills in Maintaining Lifestyle Changes

<table>
<thead>
<tr>
<th>Skills</th>
<th>Behavior target</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlling cues</td>
<td>Learn to recognize and change environmental and social cues for eating and physical activity.</td>
<td>Shop from a list, eat in one place in the house, add exercise cues to several rooms in the house, and add physical activity to social life.</td>
</tr>
<tr>
<td>Problem solving</td>
<td>Use problem-solving approach to obstacles.</td>
<td>Describe, brainstorm, choose, plan, try and see.</td>
</tr>
<tr>
<td>Eating out</td>
<td>Learn skills for eating at restaurants and the homes of others.</td>
<td>Plan ahead, choose carefully, and assertively ask for what you want.</td>
</tr>
<tr>
<td>Cognitive change</td>
<td>Talk back to common negative thoughts.</td>
<td>Recognize “all or nothing” thinking, excuses, “shoulds,” competing with others, and self-defeating thoughts. Use thought stopping and reality testing to break patterns.</td>
</tr>
<tr>
<td>Relapse prevention</td>
<td>Anticipate slips and get back on track.</td>
<td>Identify previous triggers of slips, plan ahead for likely triggers, challenge thoughts that a slip means failure (i.e., “get back on the horse”) and problem solve about how to deal with triggers.</td>
</tr>
<tr>
<td>Avoiding boredom</td>
<td>Vary physical activity to keep motivated.</td>
<td>Change some aspect of physical workout each month; take exotic cooking classes.</td>
</tr>
<tr>
<td>Social support</td>
<td>Enhance support for lifestyle change.</td>
<td>Involve significant others in activities, and develop new social supports compatible with lifestyle changes.</td>
</tr>
</tbody>
</table>
Successful Hospital Treatment and Discharge

The following steps explain how to treat people with diabetes effectively in a hospital setting.

1. Identification. The first step is to identify and treat hyperglycemic patients in the ICU or ER. A medical history of diabetes should immediately draw a red flag. Identify elevated blood glucose in all hospitalized patients. There also may be unrecognized diabetes due to the millions of individuals who are undiagnosed. Finally, in many individuals, hyperglycemia can occur some time during hospitalization as a result of illness or treatment. This hyperglycemia does not necessarily indicate the individual has diabetes. Blood glucose levels may revert to normal post-discharge.102

2. Create a collaborative team. This team should be comprised of physicians, nurses, diabetes educators, dieticians, case managers, discharge planners, and pharmacists. This team should work on diabetes management throughout the hospital.

3. Education. Develop education opportunities for all hospital staff regarding diabetes. In addition, create or gather patient education materials for a consistent message from all staff.

4. Develop a hospital-wide adherence program. Assessment, interventions, and reassessment should occur for each individual with diabetes. These interventions must follow the individual into outpatient treatment and to the home.

5. Medication reconciliation. Reconcile medications utilized in the hospital with pre- and post-hospitalization medications. Diabetes medication may need to be changed with stress as seen with illness and in hospitals. It is imperative that the medication changes are reconciled. Once the individual with diabetes gets home, instructions regarding changes, such as self-monitoring and readjusting of dosage, should be given. Communicate this to the patient, family and other caregivers in order to promote a safe and successful discharge.

6. Support continuing care post-discharge. Hospital staff should plan for a smooth transition by identifying multiple comorbidity issues with outpatient healthcare professionals. Identify insurance coverage for supplies, equipment, and medications. Seek alternative funding if insurance coverage is not available.
**Evaluation and Outcomes**

According to the *Diabetes Educator*, the following are clinical markers for diabetes management. Each of these has been discussed earlier in this addendum as to values and how each affects diabetes management.

- A1C
- Lipid control
- Urine protein
- Eye exam
- Foot exam
- Flu vaccine
- Blood pressure
- Smoking
- Diabetes self-management education
- Patient behavior
- Office visit
- Patient satisfaction
- Medical nutrition therapy
- Self-monitored blood glucose
- Height, weight

The American Association of Diabetes Educators published a position paper on outcome measurement of diabetes self-management education (DSME). This is summarized in Figure 11:

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**Figure 11.**

**Diabetes Self-Management Education**

1. Behavior change is the unique outcome measurement for diabetes self-management education.
2. Seven diabetes self-care behavior measures determine the effectiveness of diabetes self-management education at individual, participant, and population levels.
3. Diabetes self-care behaviors should be evaluated at baseline and then at regular intervals after the education program.
4. The continuum of outcomes, including learning, behavioral, clinical, and health status, should be assessed to demonstrate the interrelationship between DSME and behavior change in the care of individuals with diabetes.
5. Individual patient outcomes are used to guide the intervention and improve care for that patient. Aggregate population outcomes are used to guide programmatic services and for continuous quality improvement activities for the DSME and the population it serves.
In addition, movement forward in the CMAG quadrant system indicates improved adherence intention. As adherence intention improves, the individual with diabetes has started behavior change, which will facilitate improved diabetes management.

For further information on the National Diabetes Quality Improvement Alliance Performance Measurement Set for Adult Diabetes, access the following Web site: http://www.nationaldiabetesalliance.org/Final2005Measures.pdf.
Appendix 1: Resources and Web Links

RESOURCES

American Association of Clinical Endocrinologists
245 Riverside Ave. Suite 200
Jacksonville, FL 32202
Phone: (904) 353-7878
Fax: (904) 353-8185
Internet: www.aace.com

American Association of Diabetes Educators
100 West Monroe, Suite 400
Chicago, IL 60603
Phone: 1–800–338–3633 or 312–424–2426
Diabetes Educator Access Line:
1–800–TEAMUP4 (832–6874)
Fax: 312–424–2427
Internet: http://www.aadenet.org/

Goal sheet for purchase to set and document goals for AADE7:
http://www.aadenet.org/products/goalsheet.shtml

American College of Cardiology
Heart House
9111 Old Georgetown Road
Bethesda, MD 20814-1699
Phone: (301) 897-5400
Toll-Free: (800) 253-4636, ext. 694
Internet: www.acc.org

American Diabetes Association (ADA)
ATTN: National Call Center
1701 North Beauregard Street
Alexandria, VA 22311
Toll-free: (800) DIABETES (342-2383)
Phone: (703) 549-1500
Internet: www.diabetes.org

American Heart Association
National Center
7272 Greenville Avenue
Dallas, TX 75231
Toll-Free: (800) AHA-USA (242-8721)
Internet: www.americanheart.org

American Kidney Fund
6110 Executive Blvd., Suite 1010
Rockville, MD 20852
Toll-Free: (800) 638-8299
Internet: www.akfinc.org

American Medical Directors Association
10480 Little Patuxent Parkway, Suite 760
Columbia, MD 21044
Toll-Free: (800) 876-2632
Internet: www.amda.com

Association of Black Cardiologists
6849 B2 Peachtree Dunwoody Road, NE
Atlanta, GA 30328
Phone: (678) 302-4ABC (4222)
Toll-Free: (800) 753-9222
Internet: www.abcardio.org

Case Management Society of America
6301 Ranch Drive
Little Rock, AR 72223
Phone: 501-225-2229
Internet: www.cmsa.org

CMAG-II downloadable resource on medication adherence
Centers for Disease Control and Prevention
National Center for Chronic Disease Prevention and Health Promotion
Division of Diabetes Translation
4770 Buford Highway NE
Mailstop K-10
Atlanta, GA 30341-3717
Telephone 770-488-5000; Fax 770-488-5966

CDC-INFO Contact Center
Phone: 1-800-CDC-INFO (232-4636)
1-888-232-6348 TTY
Internet: www.cdc.gov/diabetes

Children With Diabetes
http://www.childrenwithdiabetes.com/index_cwd.htm

Joslin Diabetes Center
One Joslin Place
Boston, MA 02215
Phone: (617) 732-2400
Internet: www.joslin.org

Juvenile Diabetes Research Foundation International
120 Wall Street
New York, NY 10005–4001
Phone: 1–800–533–2873 or 212–785–9500
Fax: 212–785–9595
Internet: www.jdrf.org

National Diabetes Information Clearinghouse
1 Information Way
Bethesda, MD 20892–3560
Phone: 1–800–860–8747
Fax: 703–738–4929
Internet: diabetes.niddk.nih.gov/index.htm

National Diabetes Education Program
1 Diabetes Way
Bethesda, MD 20892–3600
Phone: 1–800–438–5383
Fax: 703–738–4929
Internet:

http://ndep.nih.gov/campaigns/tools.htm for multiple language and cultural tools for diabetes education

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)
National Diabetes Information Clearinghouse
1 Information Way
Bethesda, MD 20892-3560
Phone: (301) 654-3327
Internet: diabetes.niddk.nih.gov

Taking Control of Your Diabetes
1110 Camino Del Mar, Suite B
Del Mar, CA 92014
Phone: or 1-800-99-TCOYD
Internet: www.tcoyd.org

The Diabetic Gourmet
Internet: diabeticgourmet.com

Screening Test Examples
http://www.defeatdiabetes.org/test/
http://www.diabetes.org/risk-test.jsp
APPENDIX 2
Glossary of Terms

A1C — A blood test that measures average blood glucose over the past 2 to 3 months and is the best way to measure overall glucose control. It should be measured 2 to 4 times a year and the goal is less than 7%.

Acanthosis nigricans — a thickening and darkening of the skin in patchy areas in the skin folds of the armpits, neck, or groin, ranging from tan to dark brown. This is usually a sign of insulin resistance.

ACE inhibitor (angiotensin-converting enzyme) — a type of medication used to lower blood pressure and help treat kidney problems related to diabetes.

Adult stem cell — a cell found in the different tissues of the body – such as blood, skin or muscle – that can renew itself and produce the specialized cells needed by that tissue (known as multipotency).

Antibodies — proteins that the body makes to protect itself from foreign substances such as bacteria and viruses.

ARBs (angiotensin receptor blocker) — a type of oral medication used to lower blood pressure.

Atherosclerosis — a process that involves thickening of the blood vessel walls thought to be related to inflammation of the vessel wall, which then leads to formation of plaques, causing partial blockages. If these plaques rupture, clots form on that rupture site, causing a more acute, total blockage. If the blood vessel is providing blood to the heart, the result would be a heart attack.

Autoimmune disease — disorder of the body’s immune system in which the immune system mistakenly attacks and destroys body tissue considered foreign.

Basal insulin — the insulin that controls blood glucose levels between meals and overnight. It controls glucose in the fasting state.

Beta cells — cells that produce insulin. They are located within the islets of Langerhans in the pancreas.

Blood glucose (or just glucose) — a type of sugar that is created when the carbohydrate that one eats is broken down in the body. During digestion, glucose passes through the wall of the intestine into the bloodstream to the liver and eventually into the general circulation. From there glucose can then enter individual cells or tissues throughout the body to be used for fuel and provide energy.

Blood pressure — the pressure against the walls of your blood vessels. High blood pressure is more common in persons with diabetes and increases the risk of stroke, heart attack, kidney and eye diseases. It should be measured at every doctor visit, or at least once a year, with a goal of 130/80 mm Hg or lower.

Body mass index (BMI) — a method of determining by the relationship between height and weight whether or not a person is obese, overweight, underweight or of normal weight.

Bolus insulin — the insulin that is released when food is eaten. A bolus is a burst of insulin that is delivered by injection or by the insulin pump to “cover” a meal or snack or to correct for a high blood glucose level.

Carbohydrate counting — a meal planning method commonly used by people with diabetes to plan their food and meal choices. Carbohydrate counting helps one achieve a balance between the amount of carbohydrate foods eaten and the available insulin.
Carbohydrate — the main source of fuel for the body. Carbohydrate includes starches and sugars and are found in bread, pasta, fruits, vegetables, milk, and sweets. Carbs are broken down into a sugar called glucose.

Cardiologist — a doctor who specializes in the heart and vascular system.

Cardiovascular system — the heart and blood vessels. It is the means by which blood is pumped from the heart and circulated throughout the body. As it circulates, the blood carries nourishment and oxygen to all of the body’s tissues. It also removes waste products.

Charcot foot — a condition in which the small bones of the foot become misaligned, leading to foot deformity. It is a problem that can evolve as a result of nerve damage.

Cholesterol — a type of fat that is manufactured in the liver or intestines, but is also found in some of the foods we eat. (Only animal foods, such as eggs, milk, cheese, liver, meat and poultry contain cholesterol).

Clinical trials — carefully controlled studies that are conducted to test the effectiveness and safety of new drugs, medical products or techniques. All drugs in the U.S. undergo three phases of clinical trials before being approved for general use.

Cloning — a process for creating a genetically identical copy of a cell or an organism.

Conventional insulin therapy — an insulin therapy in which the insulin regimen is decided first and the person with diabetes has to eat and engage in physical activity according to the time actions of the injected insulins.

Creatinine — a waste product derived from the activity of the muscles. Normally, kidneys can remove this substance from the blood. A buildup of creatinine in the blood signals that the kidneys are losing their ability to function normally.

Dawn phenomenon — a rise in blood glucose levels that occurs in the early morning hours.

Diabetes educator — a healthcare person who has the skill and knowledge to teach a person with diabetes how to manage the condition. Diabetes educators may be doctors, nurses, dietitians, mental health or fitness clinicians. Some also have the credential CDE (Certified Diabetes Educator).

Diabetic ketoacidosis (also called ketoacidosis or DKA) — a condition that results from a lack of sufficient insulin in the body, leading to high blood glucose levels and ketone formation. It is an extremely serious and life-threatening condition that may lead to coma and death. The symptoms of ketoacidosis are nausea, stomach pain, vomiting, chest pain, rapid shallow breathing, and difficulty staying awake.

Diabetic macular edema — a condition that can occur in either stage of diabetic retinopathy (nonproliferative retinopathy, and a more serious stage called proliferative retinopathy) in which fluid collects in the central part of the retina resulting in blurred vision. Macular edema can be treated with laser surgery when central vision is threatened.

Differentiation — the process by which an unspecialized cell changes into a more organized or complex cell that performs a certain function, such as an insulin-producing beta cell.

Embryonic stem cell — an unspecialized cell in an embryo that can divide indefinitely (self renew) and produce any cell in the body needed after birth (known as pluripotency).

Endocrinologist — a doctor who specializes in diseases of the endocrine system such as diabetes.

Epidemiology — the study of disease patterns in human populations.
Fasting blood glucose test — a blood test in which a sample of your blood is drawn after an overnight fast to measure the amount of glucose in your blood.

Fructosamine test — a blood test that can detect overall changes in blood glucose control over a shorter time-span than the A1C test. Fructosamine levels indicate the level of blood glucose control over the past two or three weeks. Thus, when rapid changes are being made in your diabetes treatment plan, this test quickly tells you how the changes are working and whether other changes should be considered.

Gastroparesis — a condition in which neuropathy affects the nerves controlling the digestive tract and causes difficulty processing or disposing of food. It can cause nausea, vomiting, bloating or diarrhea.

Gestational diabetes — diabetes that develops during pregnancy. During this time, some women will have only a minimal insulin deficiency and will be able to adequately control their blood glucose with a meal plan. Other women may have a more severe insulin deficiency and require insulin along with nutrition therapy to control their blood glucose. This type of diabetes usually lasts only through the pregnancy, but women who have it may be at greater risk of developing type 2 diabetes later on.

Ghrelin — a hormone that relays messages between the digestive system and the brain. It works to stimulate appetite, slow metabolism, and decrease your body’s ability to burn fat.

Glucose — a simple form of sugar that is created when the body’s digestive processes break down the food we eat. Glucose is the body’s main source of energy.

Glucose meter — a device that measures one’s blood glucose levels.

Glucose tolerance test — blood test done every hour or at the 2-hour point after drinking a sugar-filled liquid. This is one test used to diagnose diabetes. If at 2 hours, your blood glucose rises to over 200 mg/dl you have diabetes. This test is not as common as a fasting glucose test.

Glycemic index (GI) — a system of ranking foods containing equal amounts of carbohydrate according to how much they raise blood glucose levels. For instance, the carbohydrate in a slice of 100% stone-ground whole wheat bread (a low glycemic index food) may have less impact on blood glucose than a slice of processed white bread (a high glycemic index food). The GI is an additional meal-planning tool to help one understand how carbohydrate foods can differ in their effects on blood glucose.

Glycemic load (GL) — a system of ranking carbohydrate foods based on how much they raise blood glucose levels that combines the GI value and the carbohydrate content of an average serving of a food, of a meal, or of a day’s worth of food.

Glycogen — glucose that is stored in muscles and liver.

HDL (high-density lipoprotein—also called “good” cholesterol) — a type of blood cholesterol that sweeps excess cholesterol from the blood back to the liver where it is reprocessed or eliminated.

Health services — services performed by health care professionals or by others under their direction for the purpose of promoting, maintaining, or restoring health.

Hormones — chemical messengers made in one part of the body to transfer “information” through the bloodstream to cells in another part of the body. Insulin is a hormone.

Hyperglycemia — high blood glucose levels. Blood glucose is generally considered “high” when it is 160 mg/dl or above your individual blood glucose target.
Hyperosmolar hyperglycemic state (HHS) — a serious condition resulting from extremely high levels of blood glucose, causing excessive urination and severe dehydration, but without ketones. It is not very common.

Hypertension — high blood pressure (blood flows through the blood vessels with a greater than normal force) which is defined as blood pressure equal to or greater than 140/90 mm Hg and affects the majority of adults with diabetes. It increases one’s risk of heart attack, stroke and kidney problems.

Hypoglycemia — a blood glucose below 80 mg/dl with or without symptoms or below 90 mg/dl with symptoms.

Hypoglycemia unawareness — a condition in which one no longer recognizes the symptoms of low blood glucose.

Impaired fasting glucose (IFG) — a fasting glucose level between 100 mg/dl and 125 mg/dl. Fasting blood test results between these levels mean that you have pre-diabetes.

Impaired glucose tolerance (IGT) — a blood glucose level after a 2-hour glucose tolerance test between 140 and 199 mg/dl. This means you have pre-diabetes.

Infusion set — plastic tubing used with an insulin pump.

Insulin — a hormone made in the pancreas that helps glucose pass into the cells where it is used to create energy for the body.

Insulin pen — an insulin delivery method that looks like a writing pen.

Insulin reaction (hypoglycemia) — low blood glucose resulting from either too much insulin, too much activity or too little food.

Insulin resistance — a condition that makes it harder for the cells to properly use insulin.

Insulin pump — an insulin delivery system; a small mechanical device, typically the size of a beeper or small cell phone, that releases insulin into the tissues of the body by way of tubing and a needle.

Insulin sensitivity factor (also called the correction factor or supplemental factor) — the amount of blood glucose measured in mg/dl that is lowered by 1 unit of rapid-acting or regular insulin. The insulin sensitivity factor is used to calculate the amount of insulin you need to return blood glucose to within your target blood glucose range.

Insulin-to-carbohydrate ratio — a method of determining how much rapid-acting insulin is needed to cover the carbohydrate eaten at a meal or snack. This is used as part of a more advanced level of carbohydrate counting.

Islet cells — cells that make insulin and are found within the pancreas; also called pancreatic beta cells.

Islet cell transplantation — transplanting islet beta cells that produce insulin from a donor pancreas into a person whose pancreas no longer produces insulin.

Islets of Langerhans — cells found in the pancreas, the most important of which are beta cells — the tiny factories that make insulin.

Intermediate-acting insulin — a type of insulin that begins to work to lower blood glucose within 1 to 4 hours and works hardest 4 to 15 hours after injection. The intermediate-acting insulins are NPH and lente.

Ketones — acids produced due to lack of enough insulin to use the glucose in your bloodstream. Your body turns to its fat stores for energy. When this occurs, ketones are produced, which accumulate in the blood and spill into the urine. These ketones are made when fat is metabolized as a source of energy. The excessive formation of ketones in the blood
is called ketosis, and the presence of ketones in the urine is called ketonuria. Allowed to go untreated, the combination of high blood glucose and ketones can lead to ketoacidosis (also called DKA).

**Ketonuria** — the presence of ketones in the urine.

**Ketosis** — the excessive formation of ketones in the blood.

**Lancet** — a small needle used to get a drop of blood from your finger, arm, or other site. The blood is placed on a special strip, which is put into the meter. The meter “reads” the strip and gives a blood glucose reading.

**Lifestyle changes** — changes made to one’s eating habits and physical activity in order to control blood glucose.

**Long-acting peaking** — a type of insulin that doesn’t begin to work to lower blood glucose until 4 to 6 hours after injection. It works hardest from 8 to 30 hours after injection and continues to work for up to 24 to 36 hours. The long-acting peaking insulin is ultralente.

**Long-acting peakless** — a type of basal insulin that begins to work to lower blood glucose within one to two hours after injection and works for 24 hours. The long-acting peakless insulin is glargine.

**Lymphocytes** — immune system cells that identify and destroy foreign agents such as viruses, bacteria and parasites.

**LDL (low-density lipoprotein)** — a type of blood cholesterol that is considered “bad” because it can be deposited in the arteries, increasing the risk of heart attack or stroke.

**Medical nutrition therapy** — a method of controlling blood glucose by working with a dietitian to assess one’s food and nutrition needs and then developing and following an individualized meal plan.

**Mediterranean-type diet** — a type of eating plan that is low in saturated fat and cholesterol, high in fruits, vegetables, nuts and grains and that also emphasizes controlling portion sizes to help in reducing overall calories.

**Metabolic syndrome** — a cluster of conditions that increase the risk of developing vascular disease (heart disease, strokes, and peripheral vascular disease). The most recognizable components of this syndrome are abdominal obesity, high blood pressure (hypertension), high triglycerides (part of the lipid profile), low HDL (the “good” cholesterol) and glucose intolerance.

**Metabolism** — the process by which the cells of the body change food so that it can be used for energy or so that it can be used to build or maintain cells and tissues.

**Microalbumin test** — a urine test that measures the presence of small amounts of a protein called albumin.

**Microalbuminuria** — the presence of small amounts of albumin, a protein, in the urine. Microalbuminuria is an early sign of kidney damage.

**Mixed dose** — an injection that contains two or more types of insulin given in the same syringe at the same time.

**Necrobiosis lipoidica diabeticorum (NLD)** — a skin condition believed to result from inflammation of the skin in which the skin thins out, becoming discolored and dimpled. This is the most specific skin problem among people with diabetes. It can be quite disfiguring.

**Nephrologist** — a doctor who specializes in conditions of the kidney.

**Nephropathy** — serious kidney disease that can occur in people who have had diabetes for a long time, particularly if their diabetes has been poorly controlled.
Neurologist — a doctor who specializes in conditions of the nervous system.

Neuropathy — damage to the nerves. It is a condition that can be very debilitating and painful. There are two main types of neuropathy, depending on which nerve cells are damaged. One type is called sensory neuropathy, which affects feelings in the legs or hands and is referred to as peripheral neuropathy. The other type is autonomic neuropathy, which affects nerves that control various organs, such as the stomach or urinary tract.

Nocturnal hypoglycemia — low blood glucose that occurs in the middle of the night.

Noncaloric or nonnutritive sweeteners — sweeteners that contribute few, if any calories and have no effect on blood glucose levels.

Nonproliferative retinopathy — the initial stage in diabetic retinopathy. High levels of blood glucose cause damage to the blood vessels in the retina. The blood vessels leak fluid, which can collect and cause the retina to swell.

Nutritive or caloric sweeteners — sweeteners that contribute calories and can affect blood glucose levels.

Ophthalmologist — a doctor specializing in conditions of the eyes.

Oral glucose-lowering medications (also referred to as oral antidiabetes medications) — “diabetes pills,” which are used in combination with a meal plan and physical activity as well as in combination with each other and sometimes with insulin to control blood glucose levels.

Outcomes — results, impacts or consequences.

Pancreas — a small gland located below and just behind the stomach that makes a specific kind of hormone called insulin.

Pathophysiology — changes that occur within an organ or tissue due to disease.

Physiologic insulin therapy (also called intensive insulin therapy) — an insulin program that attempts to provide insulin in the way that your body would if you didn’t have diabetes. Insulin is adjusted to accommodate your food intake and your activity level, and as a result insulin doses change from one day to the next.

Physiology — the study of the physical and chemical processes involved in the functioning of the human body.

Pre-diabetes — a condition in which either your fasting or two-hour post-meal blood glucose levels are higher than normal, but not high enough for a diagnosis of type 2 diabetes. Studies show that most people with pre-diabetes will develop type 2 diabetes within 10 years if they don’t change their lifestyle. They also have a higher risk of developing cardiovascular disease.

Proliferative retinopathy — a more serious stage of diabetic retinopathy in which there is a greater loss of vision or even total blindness. During this stage, abnormal blood vessels grow over the surface of the retina.

Protein — one of the main nutrients from food along with carbohydrate and fat. The body uses protein to build and repair body tissue. Muscles, organs, bones, skin, and many of the hormones in the body are made from protein. As a secondary role, protein can also provide energy for the body if carbohydrate is not available. Food sources of protein include meat, poultry, fish, eggs, dairy products and beans.

Rapid-acting insulin — a type of insulin that begins to work to lower blood glucose within 10 to 30 minutes and works hardest 30 minutes to 3 hours after injection. There are three approved rapid-acting insulins: lispro, aspart and glulisine.

Rebound hyperglycemia (high blood
glucose or the Somogyi phenomenon) — a condition in which, as a result of too low a level of glucose, the counterregulatory or stress hormones cause the liver to release too much glucose.

**Regenerative medicine** — therapies using stem cells to replace or repair damaged or defective tissue.

**Regular** — the common form of short-acting insulin.

**Relative insulin deficiency** — a decline in insulin production, which is usually a problem with or without insulin resistance early on in the course of diabetes.

**Retina** — the thin, light-sensitive inner lining in the back of your eye.

**Retinopathy** — damage to the retina, the thin, light-sensitive inner lining in the back of the eye. This damage occurs to small blood vessels in the retina which are easily harmed by high levels of glucose in the blood.

**Saturated fat** — a type of food fat that is solid at room temperature. Saturated fats raise blood cholesterol levels by interfering with the entry of cholesterol into cells causing cholesterol to remain in the bloodstream longer and to become a part of the plaque that builds up in the blood vessels.

**Self-monitoring** — managing one’s diabetes by checking blood glucose, and being aware of food intake, physical activity and medication and how each of these elements work together in order to keep blood glucose in good control.

**SMBG (self-monitoring of blood glucose)** — checking your blood glucose with a blood glucose meter.

**Short-acting insulin** — a type of insulin that begins to work to lower blood glucose within 30 to 60 minutes and works hardest 1 to 5 hours after injection. The common form of short-acting insulin is called regular.

**Single dose** — an injection that contains one type of insulin.

**Sugar alcohols or polyols** — sweeteners that replace other sugars in foods causing slightly lower rises in blood glucose.

**Trans fats** — a type of fat formed from hydrogenation, a chemical process that changes a liquid oil into a solid fat. Trans fats are found in processed foods, such as snack foods, cookies, fast foods, and some stick or solid margarines. They can raise cholesterol levels and should be eaten in as small amounts as possible.

**Triglycerides** — a type of fat stored in fat cells as body fat and burned for energy. High levels of triglycerides are linked with an increased risk of heart and blood vessel disease.

**Unsaturated fat** (both polyunsaturated and monounsaturated) — fats that comes primarily from vegetables and are liquid at room temperature. Polyunsaturated fats can help lower cholesterol levels. Monounsaturated fats also help lower blood cholesterol levels and may help to raise HDL cholesterol levels.

**Vitrectomy surgery** — a process to remove the blood and scar tissue from within the eye that can frequently successfully restore vision.
Appendix 3:
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