

TCHP

Education
Consortium

Fundamentals of Diabetes

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Introduction/Purpose Statement

As of 2005, there were 20.8 million people (7.0% of the US population) with diabetes. 14.6 million of these people have been formally diagnosed. 6.2 million have diabetes but do not know it or have not been diagnosed. 41 million people have pre-diabetes. Every 30 minutes a physician tells someone in Minnesota that they have diabetes. Every 2-½ hours someone in Minnesota dies from diabetes or causes related to diabetes. The purpose of this home study is to give you information on the pathophysiology of diabetes and its management.

Target Audience

This home study was designed for health care professionals with little to no familiarity with diabetes.

Content Objectives

- 1) Describe the four main types of diabetes.
- 2) Describe key factors associated with insulin administration.
- 3) Explain the mechanism(s) of action of the four primary categories of oral medications.
- 4) List the key characteristics of the carbohydrate-controlled diet for diabetes management.
- 5) Discuss factors influencing diabetes self-management.

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Introduction

Why is diabetes becoming so important?

As of 2005, there were 20.8 million people (7.0% of the US population) with diabetes. 14.6 million of these people have been formally diagnosed. 6.2 million have diabetes but do not know it or have not been diagnosed. 41 million people have pre-diabetes. Every 30 minutes a physician tells someone in Minnesota that they have diabetes. Every 2-½ hours someone in Minnesota dies from diabetes or causes related to diabetes.

Diabetes is the 5th leading cause of death in the United States. People living with diabetes are at an increased risk for heart disease, blindness, kidney failure, extremity amputations, and other chronic complications.

What are the risk factors for diabetes?

- A parent, brother, or sister with diabetes
- Obesity
- Age greater than 45 years
- Some ethnic groups (Native Americans, African-Americans, Hispanic Americans and Pacific Islanders)
- Gestational diabetes or delivering a baby weighing more than 9 pounds

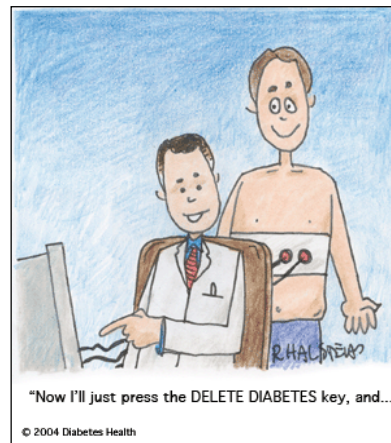
- High blood pressure
- High blood levels of triglycerides
- High blood cholesterol level

The American Diabetes Association recommends that all adults are screened for diabetes at least every three years. Patients at high risk should be screened more often.

What is the cost of diabetes?

Direct medical and related indirect expenditures resulting from diabetes were approximately \$132 billion/year. Hospitalized diabetes patients made up 43.9% of the direct medical expenditures. Indirect expenditures of \$39.8 billion resulted from missed workdays, restricted activity days, mortality and permanent disability.

Reducing health problems caused by diabetes can reduce the cost of diabetes. Improving access to health care providers, earlier diagnosis of diabetes, more intensive disease management (including comprehensive education about diabetes) and new medical technologies all contribute to a decrease in chronic health problems caused by diabetes.



What is Diabetes?

Diabetes mellitus (DM) is a group of metabolic diseases characterized by high blood glucose levels resulting from defects in insulin production, insulin action, or both.

Before we discuss management of diabetes, let's review the pathophysiology of diabetes.

First of all, the cells in our body require glucose for growth and energy. In order for glucose to enter the cell,

insulin (a hormone secreted by the beta cells in the pancreas) is required. Normally when we eat, the pancreas automatically adjusts the amount of insulin that is secreted, and the blood glucose remains stable. Even when not eating, a certain amount of insulin is needed to control blood glucose levels.

When someone has diabetes however, little or no insulin is secreted. In this situation, even though there is plenty of glucose in the blood stream, the body is unable to move it inside the cell. The kidney excretes the excess glucose from the blood stream. Therefore, the body loses its main source of energy. Even though there is plenty of glucose available, the body is unable to use it.

In general, patients with Type 1 Diabetes develop symptoms over a short period of time, and develop acute symptoms related to having high glucose and ketone levels in their blood. Ketone levels in the blood are elevated because the body thinks it needs more glucose, and has begun to convert fat into glucose. One by-product of this process is an acid called ketones.

Since Type 2 Diabetes develops slowly, some people with high blood glucose may experience few, if any symptoms and may not be diagnosed for months or even years.

Symptoms of diabetes include:

- Polydipsia (excessive thirst)
- Polyuria (excessive urine)
- Polyphagia (excessive hunger)
- Weight loss
- Blurred vision
- Fatigue
- Headache
- Slowed wound healing

How is Diabetes Diagnosed?

Diabetes is diagnosed by using any **one** of the following three methods **and confirming the finding on another day**.

1. Acute symptoms (polydipsia, polyuria, polyphagia, weight loss) along with a random (any time of the day, regardless of food) **plasma** blood glucose of 200 mg/dl or higher
2. Fasting (eight hour) **plasma** blood glucose of 126 mg/dl or higher

3. 2 hour **plasma** glucose of 200 mg/dl or higher during an Oral Glucose Tolerance Test (OGTT).

What are the different types of diabetes?

Type 1 Diabetes Mellitus was previously called Insulin-Dependent Diabetes Mellitus (IDDM) or Juvenile Onset Diabetes Mellitus (JODM).

Type 1 Diabetes occurs when the body's immune system attacks and destroys the beta cells (the cells that produce insulin) of the pancreas. This results in an absolute insulin deficiency. The only treatment for Type 1 DM is insulin.

This form of diabetes is usually seen in children and young adults. It can, however, occur at any age. Approximately 5-10% of the people with diabetes have Type 1 diabetes. Risk factors for developing Type 1 diabetes include genetic, autoimmune, and environmental factors.

Type 2 Diabetes Mellitus was previously called Non-Insulin Dependent Diabetes Mellitus (NIDDM) or Adult Onset Diabetes Mellitus (AODM).

Type 2 Diabetes is caused by a relative insulin deficiency. The pancreas in Type 2 diabetes still produces insulin, but it may not be effective or may not be produced in sufficient amounts to control blood glucose. Type 2 Diabetes begins as insulin resistance, which is the body's inability to use its own insulin properly. Because of this insulin resistance, the beta cells of the pancreas are overworked and eventually produce less and less insulin. The decreased insulin secretion and insulin resistance eventually lead to hyperglycemia.

This form of diabetes is usually seen in people over 40 years old, but is being increasingly diagnosed in children and young adults. Between 90 – 95% of people with diabetes have Type 2 Diabetes.

Risk factors include age, obesity, a family history of diabetes, a previous history of gestational diabetes or pre-diabetes, a sedentary lifestyle, and race. African Americans, Hispanic/Latino Americans, Native Americans, some Asian Americans, Native Hawaiians, or other Pacific Islanders are at higher risk to develop Type 2 Diabetes.

Pre-Diabetes includes Impaired Glucose Tolerance (IGT) and Impaired Fasting Glucose Tolerance (IFGT).

Pre-Diabetes is a term used when the fasting **plasma** glucose levels are over 100 mg/dl but less than 126 mg/dl or when the 2 hour glucose value on an Oral Glucose Tolerance Test is 140 mg/dl or higher, but less than 200

mg/dl. People with Pre-Diabetes are at high risk for developing diabetes. The risk factors for Pre-Diabetes are the same as for Type 2 Diabetes.

Gestational Diabetes (GDM) is a form of glucose intolerance that is diagnosed during a pregnancy.

Risk factors for Gestational Diabetes include obesity, over age 25, previous birth over 9 pounds, family history of diabetes and race. This type of diabetes occurs more often in African Americans, Hispanic/Latino Americans and Native Americans.

These patients require diet, exercise, and possibly insulin to control their blood glucose to avoid complications in both the mother and the baby. Women with a history of having Gestational Diabetes have a 20 – 50% chance of developing diabetes in the next 5 – 10 years.

What is the treatment for Type 1 Diabetes?

Insulin injections are required for all patients with Type 1 Diabetes because they cannot make their own insulin.

Insulin injections are usually required from one to four times a day. There are several different types of insulin. Insulins vary in how quickly they start to work and how long they are active in the body. Sometimes, a physician will order two types of insulin mixed together.

Review the diagram on the following page to learn the types of insulin, onset, peak and duration.

Using an insulin pump is another option. The insulin pump is worn at all times and delivers a continuous flow of insulin throughout the day.

Diet is also important in the management of Type 1 Diabetes, and this is discussed in more detail in the section titled: [Carbohydrate Controlled Diet for Diabetes Management](#).

Clinical Alert

Any patient scheduled on **rapid acting insulin** should have it administered *only when their meal is in front of them*. This will reduce the likelihood of the patient experiencing a hypoglycemic reaction.

Special Considerations

- Patients with gastroparesis, a delayed emptying of the stomach, need their insulin immediately prior to eating a meal or immediately after.
- A supplemental or sliding scale is a set of orders in which insulin is adjusted based on the results of pre-meal blood glucose monitoring. Supplemental insulin ordered during hospitalization should be short or rapid acting insulin. Carbohydrates consumed at meals determine maintenance doses of short or rapid acting insulin.
- Consult the Diabetes Educator when a patient is admitted with an insulin pump.



Why is Tight Glycemic Control Important?

Recent literature has indicated that **hyperglycemia is an independent marker for hospital mortality**. More simply, this means that a patient with higher blood glucose levels are more likely to die while hospitalized. A study by Umpierrez showed a total mortality rate for normoglycemic patients to be 1 - 2% compared to 18 - 19% or patients with hyperglycemia.

A second study by Van den Berghe, examined SICU patients of all types and showed an increase in mortality rates with blood glucoses of 180-200 during the hospital stay. Therefore, **any patients with hyperglycemia, regardless of whether they have diabetes, are likely to benefit from tight control.**

Clinical Pearl

- *Blood glucose greater than 200mg/dl causes a decrease in phagocytosis, which impairs the function of white blood cells, and in turn impairs healing.*
- *Blood glucose greater than 300mg/dl for 3 readings starts the process of depositing glucose on the lens of the eye which causes impaired vision.*

The benefits to the patients when tight glycemic control is maintained are:

- Decreased chance of mortality and morbidity
- Shorter hospitalization
- Favorable post discharge outcomes (less chance of infection, or poor wound healing resulting in readmission)
- Decreased health care costs.

The goals of "tight" control for the hospitalized patient are decreased hyperglycemia without hypoglycemia, efficient use of resources, and discharge on a medication regimen that is safe, practical and effective.

Insulin Reference Guide

Type of insulin	Appearance	Action	Onset	Peak	Duration	Mixable	Administration
lispro/Humalog	Clear	Rapid	5-15 min.	.5-1.5 hrs.	3-4 hrs.	Yes, only with NPH	Immediately before the meal
aspart/NovoLog	Clear	Rapid	10-20 min.	40-60 mins.	1-3 hrs.	Yes, only with NPH	Immediately before the meal
glulisine /Apidra	Clear	Rapid	10-20 min.	1-2 hrs.	3-4 hrs.	Yes, only with NPH	Immediately before the meal
Regular	Clear	Short	.5 -1 hr.	2-3 hrs.	3-6 hrs.	Yes	½ hour before the meal
NPH	Cloudy	Intermediate	2-4 hrs.	4-10 hrs.	10-16 hrs.	Yes	½ hour before the meal
glargine/Lantus	Clear	Long	1-2 hrs.	No Peak	Up to 24 hrs.	No	Once or twice a day AM and PM/HS
detemir/Levemir	Clear	Long	0.8-2 hrs.	3.2-9.3 hrs. Dose dependent	Up to 24 hrs.	No	Once or twice a day AM and PM/HS
70/30	Cloudy	Mixed	½ hr.	Peak 1: 4-6 hrs. Peak 2: 2-3 hrs.	10-16 hrs.	No	½ hour before the meal
Humalog mix 75/25	Cloudy	Mixed	5-15 min.	Peak 1: 4-10 hrs. Peak 2: .5-1.5hrs.	10-16 hrs.	No	Immediately before the meal
50/50	Cloudy	Mixed	½ hr.	Peak 1: 4-10 hrs. Peak 2: 2-3 hrs.	10-16 hrs.	No	½ hour before the meal
Novolog Mix 70/30	Cloudy	Mixed	10-20 min.	Peak 1: 4-10 hrs. Peak 2: .6-1 hrs.	10-16 hrs.	No	Immediately before the meal

What is the treatment for Type 2 Diabetes?

Two primary defects exist in Type 2 Diabetes. Although the pancreas produces insulin, it is not produced in adequate amounts. Additionally, the body does not utilize insulin properly, a characteristic called insulin resistance.

Management of Type 2 Diabetes includes diet, exercise, oral medications, insulin, or any combination of these.

There are several oral hypoglycemic agents that lower blood glucose in type 2 Diabetes.

Four Primary Categories of Oral Hypoglycemic Agents

Sulfonylureas/Meglitinides

Medications that increase insulin production by stimulating the pancreas

- glipizide (Glucotrol and Glucotrol XL)
- glyburide (Diabeta, Micronase)
- repaglinide (Prandin)
- nateglinide (Starlix)
- glimepiride (Amaryl)

Biguanides

Medications that decrease liver glucose production making body cells more sensitive to their own insulin

- metformin (Glucophage)

Thiazolidinediones

Medications that increase cell sensitivity to insulin

- rosiglitazone (Avandia)
- pioglitazone (Actos)

Alpha-glucosidase inhibitors

Medications that delay absorption of glucose from the GI tract such as:

- acarbose (Precose)
- miglitol (Glyset)

Different oral medications may be combined, or insulin and oral medications may be used together.

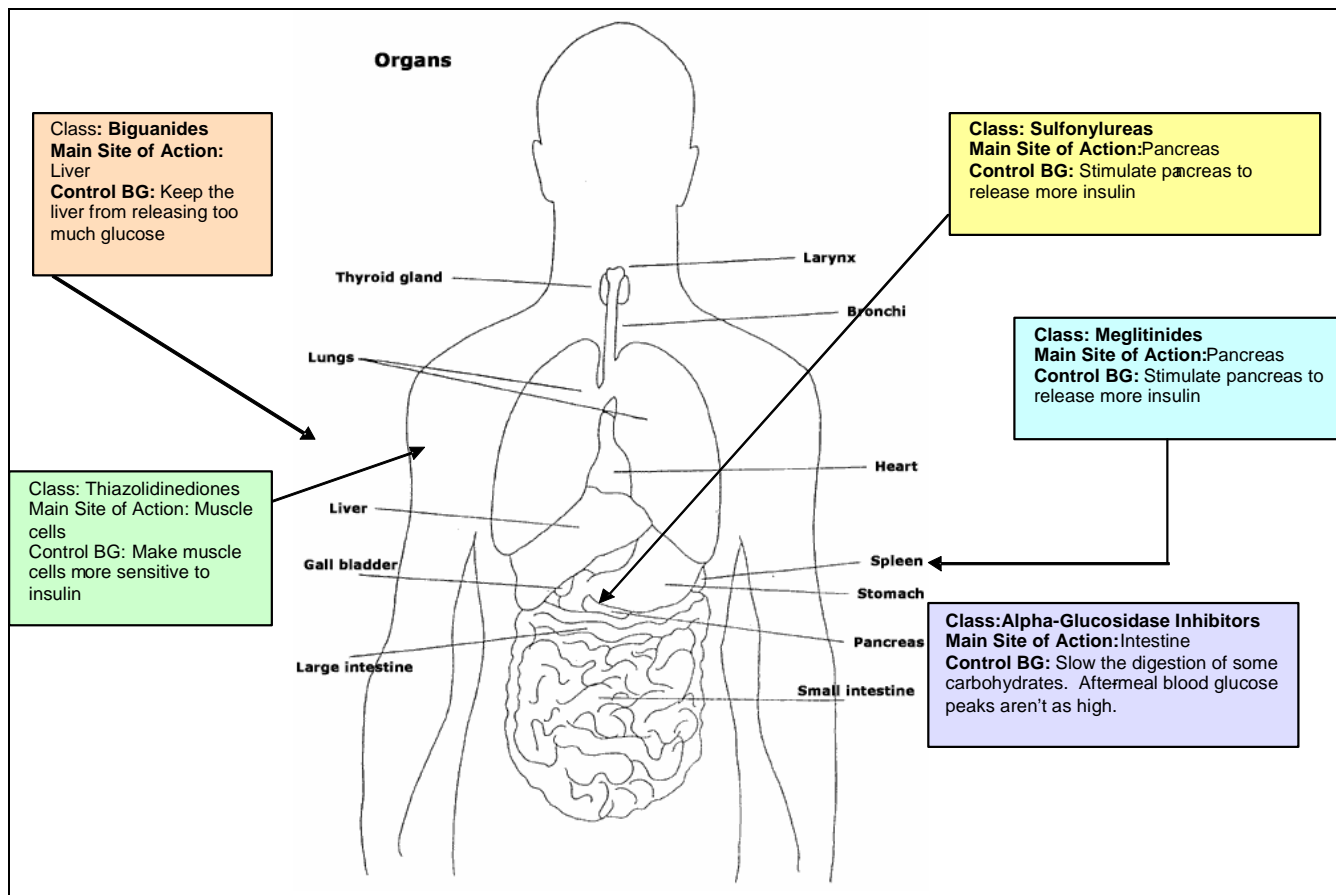
Self-management for diabetes includes:

- Self-blood glucose monitoring (SMBG).
- A controlled carbohydrate diet (previously called the ADA diet)
- Exercise
- Weight loss
- Medication use will vary depending on the person's needs.

Diabetes is a chronic progressive disease. Over time, even if the patient takes good care of their diabetes, they may need to add another class of diabetes medications and/or insulin.

Review the diagram on the following page to learn how each of the oral medications for diabetes work.

Mechanism of Action of Selected Oral Agents for Type 2 Diabetes



Biguanides

metformin (Glucophage, Glucophage XL)

Thiazolidinediones

pioglitazone (Actos)
rosiglitazone (Avandia)

Sulfonylureas

glipizide (Glucotrol/Glucotrol XL)
glyburide (DiaBeta, Micronase)

Meglitinides

repaglinide (Prandin)
nateglinide (Starlix)

Alpha-glucosidase Inhibitors

acarbose (Precose)
miglitol (Glyset)

Patient Scenario

Joshua is on glipizide 10 mg 2x/day and metformin 1000 mg 2X/day. He follows his meal plan correctly. He had a hypoglycemic reaction early this morning. The physician changed the metformin dose and the patient continues to have hypoglycemic reactions.

Can you figure out the problem after you read more about managing Type 2 Diabetes?

Oral Agents – For Type 2 Diabetes

ALPHA-GLUCOSIDASEINHIBITORS

Class	Generic Name	Available as generic?	Brand Names
Alpha-Glucosidase Inhibitors	acarbose	No	Precose®
	miglitol	No	Glyset®

Mechanism of Action: Slows the digestion of carbohydrates in the GI tract.

Comments: Take with first bite of each meal.

Advantages: Does not cause weight gain.

Side effects: Side effects include gas, bloating, and diarrhea. Start at a low dose after a meal and build up slowly.

Who shouldn't take: This medication works in the intestines. People with inflammatory bowel disease, other intestinal diseases, or obstructions should not take these medications.

Hypoglycemia: These drugs don't cause hypoglycemia when used alone. Hypoglycemia can occur when they are used in combination with certain other diabetes medication. In these cases, *treat hypoglycemia with pure glucose*, such as glucose tabs or gels. Acarbose and Miglitol slow the breakdown of fructose, so the usual treatments (4-6 oz. fruit juice, 8 oz. milk, ½ can regular pop) won't work quickly enough to raise the blood glucose.

BIGUANIDES

Class	Generic Name	Available as generic?	Brand Names
Biguanides	metformin	yes	Glucophage®
	metformin (long-acting)	yes	Glucophage ER®

Mechanism of Action: Decreases liver production of glucose and increases sensitivity to insulin.

Advantages: Does not promote weight gain and can lower cholesterol.

Common side effects: Side effects include nausea, diarrhea, and loss of appetite, but these should subside within a few weeks. To minimize these side effects start at a low dose after supper meal and increase as tolerated.

Lactic acidosis: This is a rare but serious side effect of using Metformin. Metformin should not be used in people with:

- Kidney problems
- Severe respiratory problems,
- 80 years old or older
- Taking medications for heart failure
- Have a history of liver disease,
- Drink alcohol excessively or binge drink
- Are hospitalized and may have dye-injected testing
- Are NPO for a prolonged period

If scheduled for any medical testing or surgical procedures where a person has to fast or have an iodinated dye injected into the veins, the patient should inform the doctor they are taking Metformin. Metformin should be held for 48 hours after the test and kidney function tests should be done and return in normal range before restarting the metformin.

MEGLITINIDES

Class	Generic Name	Available as generic?	Brand Names
Meglitinides (Potential to cause hypoglycemia is less than Sulfonylureas	nateglinide	No	Starlix®
	repaglinide	No	Prandin®

Mechanism of Action: Stimulates increased insulin production in the pancreas and the effects last for a shorter time than the Sulfonylureas.

Comments: Take right before main meals. May also be taken before large snacks according to the doctor's instructions. Don't take either drug if skipping a meal.

SULFONYLUREAS

Class	Generic Name	Available as generic?	Brand Names
Sulfonylureas (has potential to cause hypoglycemia)	glimepiride	no	Amaryl®
	glipizide	yes	Glucotrol®
	glipizide ER (long acting)	yes	Glucotrol XL®
	glyburide	yes	DiaBeta®, Micronase®

Mechanism of Action: Stimulates increased insulin production in the pancreas.

Cautions: These medications can cause hypoglycemia if a meal is delayed/skipped or patient is eating very little or has increases exercise without food intake.

Amaryl: A patient with kidney disease or who is elderly should be started on lower-than-usual dose.

Glipizide: Appears to be more effective when taken a half-hour before meals.

Glipizide ER: Can be taken with a meal.

Clinical Pearl: A common mistake in hospitals and clinics is to accidentally order glipizide when a patient takes glipizide extended release (24 hour). Check for this when you admit a patient.

Glyburide: Intermediate-acting, but effects may last entire day. Tends to be a little more potent than glipizide.

THIAZOLIDINEDIONES (TZDs)

Class	Generic Name	Available as generic?	Brand Names
Thiazolidinediones (TZDs)	pioglitazone	no	Actos®
	rosiglitazone	no	Avandia®

Mechanism of Action: increases sensitivity to insulin.

Comments: Often used in combination with other medications, but may be used alone. Typically takes 8-12

weeks to see the full effect on blood glucose. May cause weight gain and fluid retention.

These medications can be taken with a meal (usually the first meal). These medications, if used alone, will not cause hypoglycemia.

Liver tests: A blood test for liver function should be done before starting either drug and repeated annually. Symptoms of liver damage include nausea, vomiting, abdominal pain, fatigue, loss of appetite, and dark urine. Notify MD for any of these symptoms.

Who shouldn't take: These medications may cause fluid retention or swelling. Patients with a history of heart failure, with elevated liver tests, or those who consume an excess amount of alcohol should not take.

Women: These medications may cause women who are not ovulating and haven't gone through menopause to begin ovulating again, enabling them to conceive. Also, oral contraceptives may be less effective when taking these medications.

COMBINATIONS

Class	Generic Name	Available as generic?	Brand Names
Combinations	metformin + glyburide	No	Glucovance®
	metformin + rosiglitazone	No	Avandamet®
	metformin + glipizide	No	Metaglip®
	metformin + pioglitazone	No	Actoplus Met®

Mechanism of Action:

- *metformin + rosiglitazone and metformin + pioglitazone:* decreases liver glucose production and increases insulin production by the pancreas; also increases cell sensitivity to insulin
- *metformin + glyburide and metformin + glipizide:* decreases liver glucose production and increases insulin production by the pancreas

Cautions: See cautions for each drug in the combination as listed previously.

***Clinical Pearl:** Sometimes a person's health plan dictates which diabetes medications are available to them.*

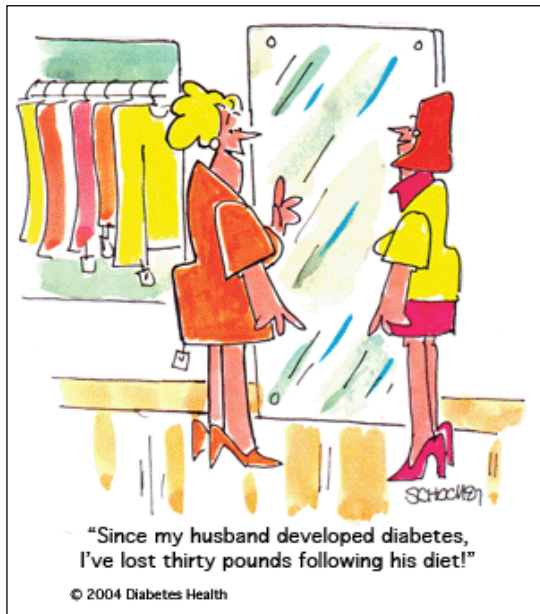
How did you do?

Patient Scenario Answer: Glucotrol stimulated the pancreas and caused the hypoglycemia. The change in the metformin dose was not the cause of the problem!

Diabetes Oral Medication Reference Guide

	Generic Drug Name	Brand Name	Main Site of Action	Timing with Meals	Frequency	Causes Hypoglycemia
Sulfonylureas	glipizide	Glucotrol®	Pancreas	½ hour before meals	1-2x / day	Yes
	glipizide (long-acting)	Glucotrol XL®	Pancreas	Take with 1 st meal	Usually 1x / day, may be given 2x / day	Yes
	glyburide	DiaBeta, Micronase®	Pancreas	Take with meal	1-2x / day	Yes
	glimepiride	Amaryl®	Pancreas	Take with 1 st meal	1x / day	Yes
Meglitinids	repaglinide	Prandin®	Pancreas	Take immediately before main meals	3x / day	Yes
	nateglinide	Starlix®	Pancreas	Take immediately before main meals	3x / day	Yes
Biguanides	metformin	Glucophage®	Liver	Take with meal	1-3x / day	No
	metformin (long-acting)	Glucophage XR®	Liver	Take with 1 st meal	Usually 1x / day, may be given 2x / day	No
Alpha-glucosidase inhibitors	acarbose	Precose®	Intestines	Take with 1 st bite of each meal	3x / day	No – treat hypoglycemia with glucose tablets or gel
	miglitol	Glyset®	Intestines	Take with 1 st bite of each meal	3x / day	No – treat hypoglycemia with glucose tablets or gel
Thiazolidinediones	pioglitazone	Actos®	Muscle	Take with meal	1x / day	No
	rosiglitazone	Avandia®	Muscle	Take with meal	1-2x / day	No
Combination	metformin + glyburide	Glucovance®	Liver + Pancreas	Take with meal	1-2x / day	Yes
	metformin + rosiglitazone	Avandamet®	Liver + Muscle	Take with meal	1-2x / day	No
	metformin + glipizide	Metaglip®	Liver + Pancreas	Take with meal	1-2x / day	Yes
	metformin + pioglitazone	Actoplus Met®	Muscle + Liver	Take with food	1-2x / day	No

Carbohydrate Controlled Diet for Diabetes Management



Dietary guidelines have been developed by the American Diabetes Association and the American Dietetic Association.

A person with diabetes should eat three meals a day at regular times. It is important not to skip or delay meals. Rapid acting insulin should be administered when the meal is ready to be eaten.

Key principles:

1. **Blood Glucose Control.** Carbohydrate consumption at meals and snacks should be consistent from day to day. Both the amount and type of carbohydrate influence blood glucose level.
2. **Reduce Fat Intake.** Limit saturated fat that comes from animal products. Limit trans fats from fast food and boxed items. Plant based oils are healthier.
3. **Achieve a healthy weight** by reducing calories and increasing physical activity. A reduction of ten pounds can improve blood glucose.

The total amount of carbohydrates ingested has the most effect on the amount of insulin or medication needed and the maintenance of blood glucose control. If the patient is on a fixed dose of insulin, carbohydrates should be consistent from day to day to prevent hyperglycemia and hypoglycemia. People with diabetes should eat at about the same times each day and try to be consistent with the types of food they choose. Carbohydrates are starch, sugar and fiber. Carbohydrates are in fruits, grains, lentils and round beans, breads, milk, sweets, potatoes, and peas.

Weight control is important in managing diabetes because many people with diabetes are overweight. Reducing calories and replacement of saturated fat with healthier monosaturated fats helps improve blood glucose levels.

For some people, moderate weight loss and increased physical activity can control diabetes without medication because it helps to reduce insulin resistance and lower blood glucose. Some patients may still need to take medications even after they make lifestyle changes.

Diet Recommendations

Limit the amount of dietary fat. The American Diabetes Association guidelines recommend that less than 7 - 10% of calories should come from saturated fat. Dietary cholesterol should be less than 200 mg per day. One positive result associated with reduction of fat in the diet may be weight loss.

Foods that are high in animal fats such as bacon, butter, regular cream cheese, fried foods, gravy, lard, shortening and regular sour cream are saturated fats and should be eaten in limited quantities.

Keep **protein intake** in the range of 15 - 20% of total calories (about 6 ounces a day) Good sources of protein that are low in fat, include nonfat dairy products, legumes, skinless poultry, fish, lean meats and low fat cheeses. A 3 ounce portion of poultry, fish, or lean meat is about the size of one deck of cards.

To reduce the risk of nephropathy, protein intake should be limited to the recommended dietary allowance (RDA) of 0.8 grams/kilogram of body weight in persons with any degree of chronic kidney disease.

Carbohydrate recommendations for the general population (not just people with diabetes) includes increasing dietary fiber in the form of whole grain breads, cereals, or pasta, brown rice, beans, fruits and vegetables.

What is considered one serving of carbohydrate or a “carbohydrate choice”? A carbohydrate choice is one serving from the starch, fruit, milk or sweets groups. One serving has approximately 15 grams of carbohydrates.

Specific recommendations	
Women	Three to four carbohydrate choices at each meal and one to two carbohydrate choices at snacks.
Men	Four to five carbohydrate choices at each meal and one to two carbohydrate choices at snacks

Foods high in sugar (sucrose) should be figured into the meal plan and used in limited amounts to substitute for other carbohydrate food sources. This includes foods such as honey, sugar, jelly, cake, pie cookies, regular soda, candy, donuts, ice cream, etc.

Factors Influencing Diabetes Self Management

Many factors contribute to how a person is managing their diabetes.

1. There may be a **language barrier** between the patient and health care provider. The patient may not be familiar with the medical language used. The patient may not speak or understand English.
2. The patient may suffer from low **health literacy**: causing him to be unable to read or understand and act upon health care information.
3. The patient may have poor **general literacy**: a limited or inability to read or write.
4. The patient may have **distrust and fear** of the health care system.
5. The patient may be used to “**one visit remedies.**” He may not understand chronic disease, and the need for ongoing medical care.
6. The patient may have **dietary preferences** or religious practices which impact following a diet.
7. The patient may have **economic factors** that affect compliance. He may be underinsured, perhaps living in poverty and cannot afford co-payments for clinic visits or medicines.

8. **Social stresses** such as work, family responsibilities, housing, schedules, etc. make following the medical regimen very difficult.
9. Failure of the **health care provider** to properly assess and educate the patient.

Patient Scenario

A 64-year-old Hmong female needs discharge instructions. No hospital interpreter is available. There is a 10-year-old granddaughter present who speaks English. Is it appropriate to use this family member to translate?

Can you figure out the problem after you read more about limited English speaking patients?

Methods to provide the best education for the limited English speaking patient

1. Always use a hospital recommended interpreter to ensure the patient understands the information. Do not use children to interpret.
2. Provide education at a level the patient will understand. Ask him/her to repeat the information to make sure it has been understood correctly.
3. Determine whether the patient can read and provide written handouts in the patient’s native language.
4. Build trust and respect with the patient. Ask him/her how he/she would like to be addressed.
5. Identify who is the decision maker for the patient and include them when providing education. Encourage the family to be supportive of the patient.
6. Identify economic issues and make a referral to the social worker.
7. Consult dietary to see if the hospital can accommodate the cultural foods of the patient and to provide nutrition counseling.

8. Assess if there are social stressors that may prevent the patient from adhering to his/her medical treatment. Reinforce the importance of health care among various competing interests.
9. Ask your patient about the influence of their spiritual or religious beliefs on their health and how it can be incorporated into their management plan.

How did you do?

Patient Scenario Answer: No, it is inappropriate for a child to address an elder about personal information. The child probably wouldn't know the medical terminology. The elder may not want the child to know about personal issues, etc.

Diabetes Education by the Nursing Staff

1. Ask the patient if he has a glucometer at home and if he monitors his blood glucose. Know what the protocol is in your institution for obtaining and teaching self-glucose management.
2. Check fingerstick blood glucose tests close to mealtime. This ensures that the insulin is an adequate amount needed to control and or correct the blood glucose.
3. Know the action of the diabetes medications ordered for your patient. Some medications (oral or insulin) need to be given ½ hour before meals while others may need to be given immediately with meals. Know which medication can cause hypoglycemia.
4. Be familiar with your institution's protocol for treating hypoglycemia. Know where the glucose tablets, glucagon and IV D50 are stocked so you can quickly access them if needed.
5. If you have questions or concerns about a dosage of medication, verify it with the MD or pharmacy **before administration.**
6. Ask the patient if he follows any specific diet to help manage his blood glucose. If he doesn't, consult the dietitian for education.

7. Diabetes education begins with the first insulin injection. All nurses are educators. You do not need to wait for the diabetes educator to begin teaching insulin self-administration. The hospital stay can be short and patients benefit when teaching is started early.

Diabetes Emergencies

One of the key survival skills all people with diabetes need to know is how to handle emergencies.

Hypoglycemia: There are several reasons a patient may develop hypoglycemia. Hypoglycemia can occur when the patient has not eaten enough, exercised too much or taken too much insulin or oral medications.

Symptoms generally start to occur when the blood glucose is lower than 70 mg/dl.

- Weakness
- Shaking
- Sweating
- Headache
- Nervousness
- Hunger

If these symptoms occur, the patient should be instructed to check their blood glucose if possible and eat or drink something with 15 grams of carbohydrates, such as fruit juice or regular soda.

Treatment should not be delayed if the patient is unable to check their blood glucose. If the



Frank discovered one of the many pitfalls of treating low blood sugar at three o'clock in the morning.

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symptoms don't begin to go away within 15 minutes, the patient should eat or drink something with 15 grams of carbohydrates again.

Instruct the family to contact the emergency room or call 911 if the following symptoms of extremely low blood glucose (hypoglycemic coma or severe insulin reaction) occur:

- Confusion
- Seizures
- Unconsciousness

If the patient has a glucagon emergency kit, a family member may administer a glucagon injection for severe hypoglycemia. Make sure the patient is sitting up or lying on their side. The glucagon may cause nausea and vomiting that could result in aspiration. Once the patient is awake and fully oriented, give an oral treatment of 15 grams of carbohydrates.

Hyperglycemia: Close monitoring of blood glucose and knowledge of symptoms associated with hyperglycemia and diabetic ketoacidosis are vitally important skills for patients with diabetes to have.

Symptoms of high blood glucose and ketones include:

- Flushed face
- Dry skin and mouth
- Nausea or vomiting
- Stomach pain
- Deep, rapid breathing
- Fruity breath odor

If these symptoms occur, the patient needs to call the physician or go to the hospital immediately. If left untreated, the result could be coma or even death.

Summary

With the increasing prevalence of diabetes in our society, careful management and comprehensive education is key to preventing or delaying complications that may occur.

A controlled carbohydrate diet, increased exercise, weight reduction and medication management are cornerstone management tools for anyone with diabetes.

Nurses should assist each patient in maintaining an optimal level of wellness, safety and quality of life while living with a chronic disease.

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Newsletters

Diabetes in Control.com

Diabetes Health Weekly Newsletter

Diabetes News- American Diabetes Association

Websites

American Diabetes Association: www.diabetes.org

American Dietetic Association: www.eatright.org

American Association of Diabetes Educators:
www.aadenet.org

International Diabetes Federation: www.idf.org

Juvenile Diabetes Foundation:

www.childrenwithdiabetes.com

Juvenile Diabetes Foundation International:

www.jdf.org

National Diabetes Information Clearinghouse

www.niddk.nih.gov/health/diabetes/ndic.htm

National Institutes of Health:

www.nlm.nih.gov/medlineplus/diabetes.html

Directions for Submitting Your Post Test for Contact Hours

To obtain a certificate of completion for this home study program, please complete the post-test and evaluation on the next few pages. The date on your certificate of completion will be the date that your home study is received. **Any materials received with a postmark after the expiration will be discarded.**

HealthEast, HCMC, & MVAMC Employees

If you are an employee of HealthEast, HCMC, or MVAMC, you may send the post-test and evaluation to TCHP for processing. Your post-test will be returned to you through your hospital. It cannot be mailed to your home.

Paid Participants

If you are not an employee of one of the TCHP hospitals, please send the post-test and evaluation to TCHP with a check for \$12.00. Please make check payable to **TCHP Education Consortium** and mail to:

**TCHP Education Consortium
Capitol Office Building
525 Park Street, Suite 120
St. Paul, MN 55103**

Your post-test will be returned to you with the certificate of completion.

Fundamentals of Diabetes Post-Test

Please print all information clearly and sign the verification statement:

Name _____
(please print legal name above)

Birth date (required)

Format: 01/03/1999

M	M	D	D	Y	Y	Y	Y

For HealthEast, HCMC, or MVAMC, employees only:

Hospital _____ Unit _____

Personal verification of successful completion of this educational activity (required):

I verify that I have read this home study and have completed the post-test and evaluation.

Signature

- 1) Characteristics of Type 1 diabetes include:
 - a) Destruction of the beta cells in the pancreas.
 - b) Usually occurs in people over the age of 40.
 - c) Responds only to insulin.
 - d) All of the above
 - e) Only a and c.
- 2) Tight control of blood glucose in people with Type 1 diabetes (as well as all hospitalized patients) is important because:
 - a) There is a decrease in the mortality rate for hospitalized patients
 - b) Shorter hospitalizations
 - c) Reduced chance of infection
 - d) All of the above
- 3) Which of the following is rapid acting insulin?
 - a) Regular
 - b) NPH
 - c) Lispro/aspart /apidra
 - d) Humalog Mix 70/30
- 4) Oral medications are predominately used in managing Type 2 diabetes.
 - a) True
 - b) False
- 5) Which of the following oral medications used to treat Type 2 diabetes functions by slowing absorption of glucose from the GI tract?
 - a) Glipizide/Glucotrol
 - b) Glyburide/DiaBeta,Micronase
 - c) Metformin/Glucophage
 - d) Miglitol/Glyset
- 6) Which of the following oral medications do NOT cause hypoglycemia?
 - a) Acarbose/Precose
 - b) Glipizide/Glucotrol
 - c) Glyburide/DiaBeta,Micronase
 - d) Repaglinide/Prandin
- 7) If a patient is on Acarbose (Precose) and also Repaglinide (Prandin), and has a hypoglycemic reaction, what would you give as an oral treatment?
 - a) Orange juice
 - b) One ampule of D₅₀ IV
 - c) One tablespoon of sugar
 - d) Glucose tablets or gel
- 8) One way to provide the best education for the limited English speaking patient is to ask the patient about the influence of their spiritual or religious beliefs on their health and how it can be incorporated into their management plan.
 - a) True
 - b) False
- 9) Which food does not contain carbohydrates?
 - a) Bread
 - b) Milk
 - c) Turkey
 - d) Apple
- 10) Dr. John Doe orders Humulin for his patient to be given supplemental scale. What did Dr. Doe mean to write?
 - a) It is not possible to know what he meant
 - b) Humalog
 - c) Regular
 - d) Human Insulin

Expiration date: The last day that post tests will be accepted for this edition is **December 31, 2016**—your envelope must be postmarked on or before that day.

Evaluation: Fundamentals of Diabetes

Please complete the evaluation form below by placing an "X" in the box that best fits your evaluation of this educational activity. Completion of this form is required to successfully complete the activity and be awarded contact hours.

At the end of this home study program, I am able to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Describe the four main types of diabetes.					
2. Describe key factors associated with insulin administration.					
3. Explain the mechanism(s) of action of the four primary categories of oral medications.					
4. List the key characteristics of the carbohydrate-controlled diet for diabetes management.					
5. Discuss factors influencing diabetes self-management.					
6. The teaching / learning resources were effective. <i>If not, please comment:</i>					

The following were disclosed in writing prior to, or at the start of, this educational activity (please refer to the first 2 pages of the booklet).

	Yes	No
7. Notice of requirements for successful completion, including purpose and objectives		
8. Conflict of interest		
9. Disclosure of relevant financial relationships and mechanism to identify and resolve conflicts of interest		
10. Sponsorship or commercial support		
11. Non-endorsement of products		
12. Off-label use		
13. Expiration Date for Awarding Contact Hours		
14. Did you, as a participant, notice any bias in this educational activity that was not previously disclosed? <i>If yes, please describe the nature of the bias:</i>		

15. How long did it take you to read this home study and complete the post test and evaluation:

_____ hours and _____ minutes.

16. Did you feel that the number of contact hours offered for this educational activity was appropriate for the amount of time you spent on it?

___ Yes

___ No, more contact hours should have been offered

___ No, fewer contact hours should have been offered.

Expiration date: December 31, 2016
