References:

1. Type 2 Diabetes Mellitus. In: *The Merck Manual of Geriatrics*. Section 8, Chapter 64. http://www.merck.com/mkgr/mmg/sec8/ch64/ch64a.jsp. Accessed September 26, 2008.
2. National Institute of Diabetes and Digestive and Kidney Diseases. National Diabetes Information Clearinghouse. Specific medications: medicines for people with diabetes. http://diabetes.niddk.nih.gov/dm/pubs/medicines_ez/specific.htm. Accessed October 8, 2008.
3. U.S. Food and Drug Administration. Diabetes information: Diabetes pills. http://www.fda.gov/Diabetes/pills.html. Accessed September 25, 2008.
4. American Diabetes Association. Other diabetes medications. http://www.diabetes.org/type-2-diabetes/oral-medications.jsp. Accessed September 28, 2008.
5. American Diabetes Association. Position Statement: Insulin Administration. http://care.diabetesjournals.org/cgi/content/full/25/suppl_1/s112. Accessed September 28, 2008.
6. U.S. Food and Drug Administration Diabetes Information: Insulin. http://www.fda.gov/Diabetes/insulin.html. Accessed September 25, 2008.
7. National Institute of Diabetes and Digestive and Kidney Diseases. National Diabetes Information Clearinghouse. Types of insulin http://diabetes.niddk.nih.gov/dm/pubs/medicine_ez/insert_C.htm. Accessed September 25, 2008.
8. National Diabetes Information Clearinghouse. What I need to know about diabetes medications. http://diabetes.niddk.nih.gov/dm/pubs/medicines_ez/index.htm#what. Accessed September 24, 2008.
9. American Medical Directors Association. *Diabetes Management in the Long-Term Care Setting Clinical Practice Guideline*. Columbia, MD: AMDA 2008.
10. American Diabetes Association. Early insulin helps type 2 diabetes. http://www.diabetes.org/diabetes-research/summaries/weng-early-insulin-helps-type2-diabetic-patients.jsp. Accessed October 25, 2008.

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Empowerment for the Future

Understanding Diabetes Medications

A Review for Health Care Staff

Diabetes

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What You Need to Know About Diabetes Medications

As a health care staff member providing care to patients with diabetes, it is important for you to be aware of the different types of diabetes medications that are being prescribed. Today, there are more treatment options and possible combinations than ever before—with different mechanisms of action or methods of delivery. This brochure will help you understand these differences.

The 2 main categories of diabetes drugs are oral diabetes medications (antihyperglycemic pills) and insulin (injections via syringes, pens, or pumps). Regardless of which treatment is chosen, the goal is to control glucose to reduce symptoms and slow progression of complications while minimizing hypoglycemic episodes.[1]

About Oral Diabetes Medications

If the patient's body still produces some insulin, oral diabetes medication may be prescribed. Oral diabetes medications help control blood glucose and are usually prescribed to patients with type 2 diabetes in conjunction with recommendations for specific dietary changes and exercise.[1,2]

Reminder From the FDA[3]

"Diabetes pills only work for people whose pancreases still make some insulin, so they cannot help people with type 1 diabetes. Diabetes pills are not insulin. Instead, they help lower blood sugar in other ways."

—U.S. Food and Drug Administration

The oldest diabetes drugs, sulfonylureas, stimulate the beta cells of the pancreas to release more insulin.[4] Sulfonylureas have been available since the 1950s, but since then several new classes have been developed that:

- Help the pancreas release insulin[4]
- Increase the body's sensitivity to the insulin it has and thus reduce insulin resistance in peripheral tissues (muscles and liver), which is found in most patients with type 2 diabetes[1]
- Slow down the breakdown of food into glucose[2,3]

The following chart shows oral diabetes medications by type.

Oral Diabetes Medication Categories at a Glance[2,4]

Category	Mechanism of Action	Some Possible Side Effects
Sulfonylureas	▶ Stimulate the pancreas to make more insulin, which lowers blood glucose	▶ Hypoglycemia ▶ Upset stomach ▶ Skin rash or itching ▶ Weight gain
Biguanides (metformin)	▶ Decrease amount of glucose produced by liver ▶ Also increase the body's insulin sensitivity, so more glucose is absorbed and blood glucose is lowered	▶ May make patients sick if they drink > 2 to 4 alcoholic drinks per week ▶ May worsen kidney problems ▶ Nausea, diarrhea, stomach symptoms
Meglitinides	▶ Stimulate pancreas to make more insulin, which lowers blood glucose	▶ Hypoglycemia ▶ Weight gain
Thiazolidinediones	▶ Reduce glucose production in liver ▶ Also increase the body's insulin sensitivity, so more glucose is absorbed and blood glucose is lowered	▶ Liver disease ▶ May reduce effectiveness of birth control pills ▶ Weight gain ▶ Anemia ▶ Edema in legs and ankles
Dipeptidyl peptidase IV (DPP-4 inhibitors)	▶ Help the body's natural glucose-reducing compound GLP-1 remain active longer, which lowers blood glucose	▶ Relatively new class of medications ▶ Only 1 DPP-4 inhibitor available
Alpha-glucosidase inhibitors	▶ Block enzymes that digest starches, to slow the rise in blood glucose levels after meals	▶ Gas, bloating, diarrhea
Combination of drugs with different mechanisms of action (eg, a biguanide and a sulfonylurea)	▶ Combined action of the drugs work together to lower blood glucose levels	▶ Increased risk of side effects from combining drugs ▶ Hypoglycemia

About Insulin

Insulin is necessary for normal carbohydrate, protein, and fat metabolism.[5] People with type 1 diabetes do not produce enough insulin and must depend on exogenous insulin to sustain life. People with type 2 diabetes may, over time, make less insulin and need additional insulin for adequate blood glucose control.[1]

Insulin cannot be taken by mouth because it gets broken down by the body. Therefore, insulin is typically given by injection via syringes, insulin pens, insulin jet injectors, or insulin pumps. Technology has made insulin delivery devices more convenient, and research is ongoing toward finding other new methods to get insulin into the bloodstream.[6]

How Insulins Vary[1,6,7]

Insulin preparations vary by onset of action, time of peak action, and duration of activity.

Onset: How soon the insulin starts to lower blood glucose: rapid-acting, intermediate-acting, long-acting, or a combination

Peak: The time insulin works the hardest to lower blood glucose

Duration: How long the insulin effect lasts

There are now more than 20 types of insulin products available, with a varying onset, peak, and duration of action. The choice of insulin is generally based on the patient's lifestyle, the physician's preference and experience, and the patient's glucose levels.[6]

Insulin Delivery Devices

Following is a brief synopsis of the delivery devices for insulin. These devices inject insulin through the skin into the fatty tissue below.

Syringes[5,6,8]

- Use a needle attached to hollow barrel for subcutaneous injection into upper arm, thigh, buttocks, and/or abdomen
- Are available in various sizes to match strength and dosage
- Some insulins of different types come in the same bottle, and others can be mixed together
- Whenever possible, take steps to minimize painful injections, such as injecting insulin at room temperature, making sure no air bubbles remain in the syringe, keeping muscles in injection area relaxed, penetrating skin quickly, and rotating injection sites

Pens[6]

- Work like syringe but look like pens with cartridges
- Have fine, short needles and are filled with insulin
- Some use replaceable cartridges; others are prefilled and disposable
- Users turn a dial to select dose and press a plunger to deliver dose

Pump[6,8]

- Small device (cell-phone size) worn outside the body
- Pump is connected by flexible tubing to a catheter located under skin of abdomen. A very small needle is inserted under the skin that may stay in place for several days
- Insulin is pumped from a machine to the patient's body, allowing close control without multiple injections
- Delivers small, steady dose but also can deliver additional amount in a short time if needed, such as after a meal

Jet Injector[6,8]

- Consists of a pen-shaped injector device that injects the insulin through the skin
- Sends a fine spray of insulin through the skin
- Uses high-pressure air instead of a needle

Reaching Glycemic Control

When choosing medications for diabetes, remember:

- Dosages must be individualized and should be selected in consideration of the patient's blood glucose level and lifestyle[5]
- Diabetes medications are meant to be prescribed in tandem with lifestyle (diet and exercise) recommendations[5]
- Oral hypoglycemic agents with different mechanisms of action can be used together and/or with insulin[1]
- Insulin may be added when glucose is not adequately controlled by oral drugs alone[9]
- Insulin can be started or added earlier in treatment when glucose is not adequately controlled. Blood sugar control can help reduce risk of serious complications from diabetes[9]
- You may see more patients with newly diagnosed type 2 diabetes on insulin; recent studies have found that the earlier use of insulin can help such patients[10]

Regimens vary widely: each patient's treatment plan should meet the individual's needs and may need to be modified over time as that patient's condition changes.[1] Whenever possible, the simplest effective regimen that works for the patient should be prescribed. Many patients and their caregivers are willing and able to adhere to their treatment plans, especially with appropriate education.[1]

Prognosis

The prognosis for patients with diabetes varies and depends on optimal control of glucose and coexisting risk factors. However, diet, daily physical activity, and drugs that reduce glucose levels can help your patients manage their diabetes.[1] As a health care staff member, you can help your patients with diabetes reach their goals by educating them and their loved ones about the disease, treatment options, and their individualized treatment plans.