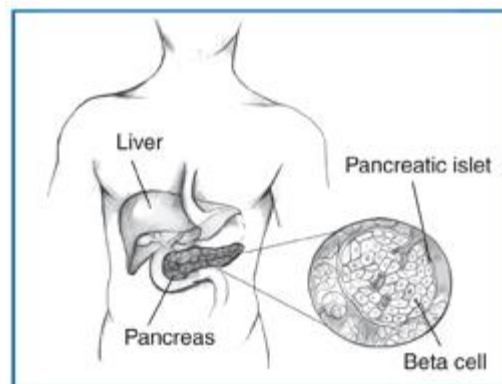


DIABETES

Diabetes is a group of diseases with a variety of causes which result in high blood glucose. When an individual has diabetes, the body does not produce **or** does not adequately use the insulin produced by the body. Insulin is a hormone which is normally produced in the pancreas. The pancreas contains clusters of cells called islets. Beta cells within the islets make insulin and release it into the blood. When an individual eats foods with carbohydrates, the digestive tract breaks down the carbohydrates into glucose, a form of sugar that enters the bloodstream. Insulin is needed to move the glucose into the cells so the body can use it for energy needed for daily life. Without insulin, glucose accumulates in the blood and urine resulting in a diagnosis of diabetes.



Types of Diabetes

1. Type 1 Diabetes

Type 1 diabetes is usually diagnosed in children, teens, and young adults, but it can occur at any age. Type 1 diabetes is caused by a complete lack of insulin. Because of this, glucose cannot enter cells to be used for energy. Blood glucose remains high as long as insulin is missing. People with type 1 diabetes must take insulin for life in order to live. This means undergoing multiple injections daily or having insulin delivered through an insulin pump. In addition, it requires testing blood glucose by pricking the finger for blood multiple times a day, or using a continuous glucose monitor (CGM), described later in this document. About 5-10% of all cases of diabetes are type 1.

Type 1 diabetes is an autoimmune disease which means that the immune system, which normally attacks harmful bacteria and viruses, appears to mistakenly destroy the insulin-producing beta cells in the pancreas. Other contributing factors may be genetics and/or exposure to environmental triggers such as viruses.

2. Type 2 Diabetes

Type 2 diabetes is the most common form of diabetes after the age 45 (90-95% of all cases of diabetes are type 2). The body may become insulin resistant meaning the insulin does not act normally to keep blood glucose in the desired range. Initially, increased amounts of insulin may be produced, but eventually the amount of insulin produced will diminish.

For these individuals, a diabetes pill may help make enough of their insulin available to control diabetes **or** the pill may help these individuals use their own insulin better. Many people with type 2 diabetes eventually take insulin to control their blood glucose levels.

Risk factors for type 2 diabetes include: 1) being overweight: Fatty tissue increases the cell's resistance to using insulin; 2) inactivity: Exercise helps the cells become more sensitive to insulin; 3) family history: Having a parent or sibling with type 2 diabetes (including having a mother who experienced gestational diabetes) increases risk; 4) ethnicity: Type 2 diabetes is more common in African American, Native American, Hispanic, Asian American and Pacific Islander heritage; 5) age: Individuals over age 45 are at increased risk, although there has been a significant increase in children, teens and young adults with type 2 diabetes; and 6) pre-diabetes: A fasting blood glucose between 100 and 125 mg/dl is a sign of pre-diabetes indicating the need for good medical intervention.

A1C (formerly known as Hemoglobin A1C) measures overall diabetes control. A small amount of glucose and hemoglobin stick together until the red blood cell dies (this occurs in direct proportion to the amount of glucose present, so higher glucose levels mean higher A1C levels). The lifespan of a red blood cell is about 120 days, which is why the A1C test is a good measure of the average blood glucose levels over the past 2-3 months. This test is usually performed every 3 months for those out of target range and every six months for those in stable control. An average normal range of this test is 4-6%. Diabetes is diagnosed at an A1C of greater than or equal to 6.5.

The American Diabetes Association changed recommendations for target A1C levels in people with diabetes in 2014. The goal for all children (0-18 years) is to aim for an A1C of 7.5%. For adults, the goal is 7.0% or lower, so the lower the A1C the better as long as there are not too many episodes of low blood glucose. The chart below compares A1C values to estimated Average Glucose.

A1C %	Blood Glucose Correlations mg/dL
6	126
7	154
8	183
9	212
10	240
11	269
12	298

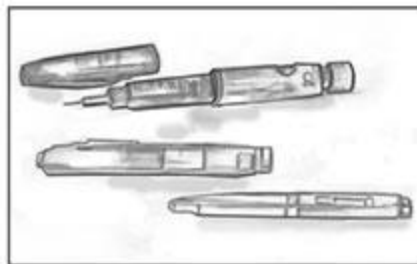
American Diabetes Association, A1C and eAG. Retrieved May 14, 2018 from <http://www.diabetes.org/living-with-diabetes/treatment-and-care/blood-glucose-control/a1c/>

Medical Management

The main goal of managing diabetes is to maintain the blood glucose level as close to normal as possible. There are four important factors that result in control of blood glucose. These are:

- taking insulin/medications,
- following a healthy meal plan,
- frequent blood glucose monitoring, and
- participating in regular exercise.

Insulin (delivered by injection or by insulin pump)



The Diabetes Control and Complications Trial (DCCT) was a 10 year research study which showed that better glucose control reduced the likelihood of future complications. Because of the DCCT study, more people choose intensive diabetes management which involves more frequent glucose monitoring and the routine use of more than two shots of insulin a day. Often Regular, Humalog, NovoLog or Apidra insulin is given three (3) times a day at mealtime, and a longer-lasting insulin is given at breakfast and/or bedtime. Insulin action varies from person to person, sometimes from day to day. Site of injection and exercise may also influence insulin action. **Please note that a vial or cartridge of insulin, once opened, should only be used for a month.** Open vials of insulin can be kept at room temperature. Unopened insulin should be kept in the refrigerator. It is most important to avoid exposing insulin to extreme temperatures.

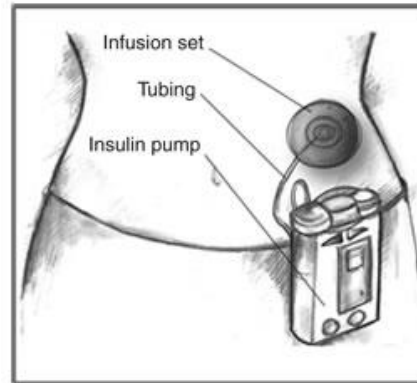
There are 5 classes of insulin:

1. Rapid-acting: Insulin lispro (Humalog & Admelog), insulin aspart (NovoLog) & insulin glulisine (Apidra) generally have a rapid onset of 15 minutes after injection, peaks in about 60 minutes and last 2-4 hours. These insulins are typically given before eating. Insulin aspart (Fiasp) is a new fast-acting insulin given at mealtime or snacks. It enters the bloodstream in about 2 ½ minutes and can be given either at the beginning of eating or up to 20 minutes after starting to eat.
2. Regular or short-acting: Types include Human Regular (Humulin R, Novolin R, Velosulin R). These usually reach the bloodstream within 30 minutes after injection, peaks from 2-3 hours and is effective for about 3-6 hours. Intermediate-acting: NPH (Humulin N, Novolin N, ReliOn) usually reaches the bloodstream in 2-4 hours after injection. This insulin may be mixed with the short-lasting insulins. Peak is usually 4-12 hours after injection and is effective for 12-18 hours.
3. Long-acting: Types include detemir (Levemir) and glargine (Basaglar, Lantus). It reaches the bloodstream several hours after injection generally lasts 20- 24 hours without a peak like other insulins.
4. Ultra long-acting: degludec (Tresiba) and glargine u-300 (Toujeo) lasts up to 36 hours, although the main action is the first 24 hours.

Insulin Pump

Insulin pumps are small computer-like devices that deliver insulin (rapid-acting) through a plastic tubing placed under the skin with a needle. After insertion, the needle is removed leaving the plastic cannula in place. This tubing is changed every 2-3 days. Some pumps are wireless requiring no tubing. The pump delivers insulin two ways. First is by a pre-set basal rate. The basal rate is set by the student and/or family at home and is not changed at school. It is delivered continuously throughout the day and night. Second is by a bolus of insulin which is given before or after eating. The amount is determined by the individual based mainly on carbohydrate intake and current blood glucose level. Insulin pump therapy has shown to decrease complications related to diabetes. It is an effective therapy for routine diabetes care for

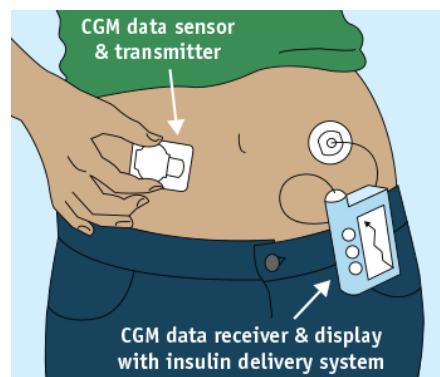
children, adolescents and adults. Pump therapy is not for everyone and there is no defined age for an individual to begin using a pump. It requires a commitment from the family and the individual with diabetes.



For more detailed information: American Diabetes Association, Insulin Pumps.
http://www.diabetesforecast-digital.org/diabetesforecast/march_april_2020/MobilePagedReplica.action?pm=2&folio=60#pg60

Continuous Glucose Monitor (CGM)

CGM is a device that uses a sensor that is inserted just beneath the skin to measure glucose levels that closely correlate with blood glucose. It transmits these readings every few minutes throughout the day and night to an insulin pump or monitor. This allows an individual to make changes in their diabetes management after reviewing the data. **It is important to note that a finger stick may be required to obtain an accurate blood glucose reading.** Insulin or other treatment decisions should never be given based on the reading of the CGM unless otherwise noted in the orders from the health care provider.



CGMs have become more popular and accurate. There is a new concept called “time in range”. As the CGM gathers data, it can report the percentage of time an individual has spent within a target glucose range, as well as time spent above and below targets. As this feature becomes more uniform across all CGMs, it will hopefully offer more information about time in range by day, week or time of day.

Time in range goals: For most people with type 1 and type 2 diabetes, the goal is that at least 70% of readings are between 70-180 mg/dl, or roughly 17 out of 24 hours in range each day.

Oral Medications

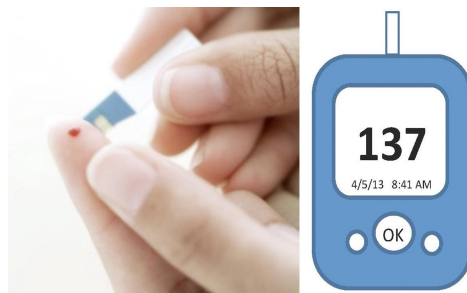
Other than insulin, metformin is the main medication used in children with type 2 diabetes. Metformin helps the body use insulin more effectively and it decreases the release of stored glucose from the liver. Other medications may be used if glycemic goals are not met.

Healthy Meal Plan

The ideal healthy meal plan for individuals with diabetes is the same healthy diet that would benefit all. Nutrition management for people with diabetes should be individualized depending on lifestyle and usual eating habits. A healthy diet is one that a) emphasizes fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products; b) includes lean meats, poultry, fish, beans, eggs and/or nuts; and c) is low in saturated fats, trans fats, cholesterol, salt and added sugar.

Blood Glucose Monitoring

Blood glucose testing is important for management of diabetes. Meter testing provides an accurate reading of blood glucose. Meters use strips which electronically read and display the level of blood glucose.



Testing supplies (monitor, test strips, lancet device and lancets) should be available in school and are provided by the family. Those with type 1 or type 2 who use insulin, will do several finger sticks a day (unless using CGMs that do not require it). Those with tighter glucose targets will most likely monitor their blood glucose more frequently. Each student's Individual Health Plan will define what is best for them.

Activity/Exercise

Regular exercise is important for the best control of diabetes. The Physical Activity Guidelines for Americans (<http://www.cdc.gov/physicalactivity/basics/children/index.html>) recommends a minimum of 60 minutes of exercise daily for all children and adolescents. Exercise helps lower blood glucose levels and improves insulin sensitivity which means it works more efficiently. In general, exercise helps individuals feel better and helps to maintain body weight.

Acute Complications of Diabetes Which May Result in Emergency Situations

Acute complications of diabetes include low blood glucose reactions (hypoglycemia) and high blood glucose (hyperglycemia).

1. [Hypoglycemia](#) (blood glucose is <70 mg/dl OR as defined in each individual's plan).
 - a. Onset is usually quick.
 - b. May be due to too much insulin, increased exercise, a delayed meal or reduced food intake.
 - c. Symptoms are variable for each individual, but may present in a variety of ways including irritability, sweating, headache, hunger, confusion, tiredness, shakiness, or headache among other symptoms.
 - d. Treatment includes 15 gm fast-acting carbohydrate with a blood glucose check in 15 minutes, sometimes referred to as the 15-15 rule (refer to the student's individual health plan for specific guidelines as some students may require less grams of carbohydrates to treat a low).
 - e. **All students with possible low blood glucose should be accompanied to the health office for further assessment and intervention.**
 - f. Severe hypoglycemia may lead to unconsciousness or convulsions resulting in the need for glucagon either via injection or nasally. Glucagon is a hormone produced in the pancreas that stimulates the liver to release stored glucose into the bloodstream when blood glucose levels are too low.

2. [Hyperglycemia](#) (blood glucose is >250-300 mg/dl, depending on student's plan).
 - a. Onset is gradual.
 - b. May be due to too little insulin, too much food, stress, decreased exercise, or some medications such as corticosteroids.
 - c. Symptoms may include increased thirst, frequent urination, tiredness, or blurry vision. Treatment includes fluids, parent contact, ketones if ordered, and following the student's plan.
 - d. Common symptoms of prolonged hyperglycemia include: signs of dehydration, nausea and/or vomiting, abdominal pain, acetone breath, or rapid respirations among other symptoms. Blood glucose levels are too high (over 300 mg/dl), insulin levels are too low, the body starts breaking down fat which contributes to ketones in the blood, and the liver starts making glucose which causes the blood

glucose levels to increase. High levels of glucose and ketones make the blood more acidic causing increased urination (spilling both sugar and ketones in the urine) and dehydration, which is then called diabetic ketoacidosis (DKA). Untreated DKA may result in coma and death. This requires immediate medical attention.

Long-term Complications

Research shows that in people with diabetes, the small blood vessels are **relatively** protected from changes before puberty, even with poor blood glucose control. After puberty, that changes in those with chronically high A1C levels, possibly because of all the hormone changes which can elevate blood glucose. The complications may be due to the hormones, high blood glucose or combination of both. Complications include:

- Eye problems (possibly cataracts and changes to the retina). Annual eye exams are recommended for those who have lived with type 1 diabetes for 5 or more years, starting at age 10 or at puberty. Those with type 2 diabetes should have an eye exam soon after diagnosis if 10 or older.
- Kidney problems. This is more common in those who have had diabetes a long time **and** those with poor control with elevated A1C levels, elevated blood pressure, and in those who smoke or chew tobacco. Annual screening for microalbuminuria is recommended.
- Nerve damage. Usually seen after puberty in those who have a history of high glucose levels for a long time. The DCCT found 60% less damage in those with lower A1C levels.

Illness

Acute illness can cause hyperglycemia. The child may spill glucose in the urine and develop ketones as well. It is important to monitor the blood glucose and ketones more closely during times of illness (every 4 hours). Insulin and food requirements will change during this time and need adjusting again as the child convalesces. During illness, fluids for calories and electrolytes are essential. At this time, children should be managed at home.

Management at School

Most children with diabetes are able to keep the disease under good control with careful daily management of diet, exercise, insulin and blood glucose monitoring. At school, the health office staff may be involved in monitoring and teaching. The school nurse will consult with the family and health care provider annually and throughout the school year as needed, to develop an **Individualized Health Plan** which outlines the treatment at school. This may include: 1) treatment for hypoglycemic episodes; 2) equipment for blood glucose monitoring; 3) short-acting insulin for lunch (insulin to carbohydrate ratio) and a correction factor to treat hyperglycemia; 4) Ketostix to check ketones in the urine for BS >300 mg/dl or whatever level the health care

provider indicates; 5) glucagon for severe hypoglycemia and 6) specific plan for students wearing insulin pumps or CGM's. A briefer document called the **Diabetes Emergency Action Plan** is developed and distributed to all staff who have contact with the student with type 1 diabetes.

It is recommended that all individuals with diabetes wear a medic-alert tag. Children with diabetes are able to participate in all school activities. School attendance and school achievement may be two parameters to use in assessing the child's coping and general management of their diabetes.

Health Care Referral

Students with a blood glucose >300, with small to moderate ketones in the urine and no symptoms such as abdominal pain, nausea or vomiting, may be managed at school with orders for insulin to reduce the high blood glucose. Students should also drink plenty of water and avoid exercise. Communicate with parent/guardian or emergency contact.

Students with moderate ketones in the urine and symptoms such as abdominal pain, nausea or vomiting OR large ketones in the urine should be excluded. Ketones upset the chemical balance of the blood and are an indicator that there are problems with diabetes management. A strong recommendation should be made to parents to follow the student's sick day plan and communicate with their health care provider as needed. If a parent/guardian or emergency contact is unavailable in these circumstances, 911 is to be called and best practice is for the school nurse to contact the health care provider to inform them of the need for the emergency transport.

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