Insulin is a hormone made by the beta cells in the pancreas. Insulin allows sugar to go from the bloodstream into the body’s cells and be used for energy. Insulin lowers blood sugar.

**insulin facts**

- A person cannot survive without insulin. Insulin is needed in the body 24 hours a day even if you are not eating.
- People with Type 1 diabetes make little or no insulin so they need multiple daily insulin injections. This is due to the fact that there is not a single insulin which can completely control the blood sugars throughout the day. Therefore, an injection will be needed with each meal and at bedtime.
- People with Type 2 diabetes may still produce insulin, but are unable to use it well. Some may need insulin to help control blood sugar levels.
- At this time, insulin does not come in a pill but this is being researched as a possibility.

**storage of insulin**

- Refrigerate but make sure it does not freeze! Once opened, a vial may be left at room temperature.
- New vials need to be opened every 28–30 days. This is because insulin weakens 28–30 days after the vial has been punctured with a needle.
- Write the date on the vial or change vials on the same day each month.
- Insulin may lose its strength if exposed to very high or very low temperatures.
  - If the outside temperature is very warm (above 86°F or 30°C), the insulin must be kept in a cooler. *Frio coolers are an example of coolers available for insulin storage. These can be purchased online.*
  - If the temperature is at freezing or below (less than 32°F or 0°C), the insulin must be protected from freezing.

**what you need to know about your insulin**

In the United States, insulin is synthetically made in a laboratory and is most like human insulin.

**Information that you need to know about insulin:**

1. Name of each insulin,
2. Types of your insulin(s),
3. Doses—Insulin is measured in units.
4. Always have an extra supply of each insulin available.

**insulin types**

<table>
<thead>
<tr>
<th>Name</th>
<th>Onset of Action</th>
<th>Peak Action</th>
<th>Working Time</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid Acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apidra</td>
<td>10–15 minutes</td>
<td>1 hour</td>
<td>2–4 hours</td>
<td>Clear</td>
</tr>
<tr>
<td>Humalog</td>
<td>10–15 minutes</td>
<td>1–2 hours</td>
<td>3–5 hours</td>
<td>Clear</td>
</tr>
<tr>
<td>Novolog</td>
<td>10–15 minutes</td>
<td>1–2 hours</td>
<td>3–5 hours</td>
<td>Clear</td>
</tr>
<tr>
<td><strong>Long Acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basaglar/Lantus</td>
<td>1–2 hours</td>
<td>None</td>
<td>Up to 24 hours</td>
<td>Clear</td>
</tr>
<tr>
<td>Levemir</td>
<td>1–2 hours</td>
<td>None</td>
<td>Up to 24 hours</td>
<td>Clear</td>
</tr>
</tbody>
</table>

*Long acting insulins are also known as basal insulins.*
basal-bolus insulin regimen basics

Basaglar or Lantus insulins
These are basal or “background” insulins. As basal insulins, these insulins control the blood sugar in a fasting or non-eating state.

- Basal insulins need to be given daily. For kids school age or older, this will be at bedtime. For younger kids, this may be in the morning.
- Basal insulins are to be given consistently at the same time each day.
- This dose will be determined by your physician and will increase as your child grows. Example: A 2-year-old will have a much smaller dose than a 16-year-old.
- When food is eaten, it will cause the blood sugar to rise. Basal insulins are not able to keep the blood sugar at the ideal level due to the sugar from the food. This requires the use of a second insulin, Novolog or Humalog.

Novolog or Humalog insulins
These are rapid acting insulins used at mealtimes and at times when the blood sugar is too high.

- Novolog and Humalog insulins are essentially the same type insulin but made by different companies. Your insurance will determine which insulin is prescribed for your child.
  - As Novolog is utilized by Dayton Children’s Hospital, Novolog will be used in the following instructions.
- Each Novolog meal dose will be based upon the following:
  - Blood sugar just before the meal
  - Amount of carbohydrates (carbs) eaten at the meal (called carb dose)
  - Once given, Novolog starts lowering the blood sugar in 15 minutes. Novolog works strongest or peaks 1–2 hours after being given. This is the time at which Novolog lowers the blood sugar the most. Due to this peak, Novolog should not be given sooner than 2 hours from the last Novolog dose as this would put your child at risk for low blood sugar.
- The dose for a high blood sugar is known as just the correction dose.
  - You will be given a target range for your child’s blood sugars (example: 80–150).
  - When a blood sugar is above the target range, extra Novolog insulin will need to be given to correct the blood sugar down to the target range.

Example target range and correction dose for child who is school age or older

<table>
<thead>
<tr>
<th>Joe’s target blood sugar range is 80-150</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Correction Scale</strong></td>
</tr>
<tr>
<td>Blood Sugar</td>
</tr>
<tr>
<td>150–200</td>
</tr>
<tr>
<td>201–250</td>
</tr>
<tr>
<td>251–300</td>
</tr>
<tr>
<td>301–350</td>
</tr>
<tr>
<td>351–400</td>
</tr>
<tr>
<td>Above 400</td>
</tr>
</tbody>
</table>

For a younger child, the correction scale will be weaker, meaning less insulin will be needed to correct the blood sugar to the target range.

answer
Joe’s blood sugar before lunch was 230. Joe will need to take 2 units of Novolog to correct the blood sugar down from 230 to the target range of 80–150.
carb dose

The Novolog dose for carbs is determined by the carb-to-insulin ratio. The ratio(s) will be determined by your doctor.

The following are examples of different ratios that may be prescribed.

• **Example A:** Your child has a carb-to-insulin ratio of 10 grams of carbs to one unit of Novolog. This means that your child will take 1 unit of Novolog insulin for every 10 grams of carbs eaten.
  - Your child eats 30 grams of carbs. \( 30 \div 10 = 3 \text{ units} \)
  - This means that your child needs 3 units of Novolog for eating 30 grams of carbs.

• **Example B:** The carb to insulin ratio is 15 grams of carbs to one unit of Novolog.
  - Your child eats 46 grams of carbs. \( 46 \div 15 = 3.067 \)
  - Round to the nearest \( \frac{1}{2} \) unit. The dose would be 3 units.

• **Example C:** The carb to insulin ratio is 20 grams of carbs to one unit of Novolog.
  - Your child eats 68 grams of carbs. \( 68 \div 20 = 3.4 \)
  - Round to the nearest \( \frac{1}{2} \) unit. The dose would be 3.5 units.

---

**Example:**

First, determine the correction dose.

The pre-lunch blood sugar was 244 and 71 grams of carbs were eaten. The ratio for this meal is 10 grams: 1 unit Novolog

<table>
<thead>
<tr>
<th>Blood Sugar</th>
<th>Units of Novolog</th>
</tr>
</thead>
<tbody>
<tr>
<td>150–200</td>
<td>1</td>
</tr>
<tr>
<td>201–250</td>
<td>2</td>
</tr>
<tr>
<td>251–300</td>
<td>3</td>
</tr>
<tr>
<td>301–350</td>
<td>4</td>
</tr>
<tr>
<td>351–400</td>
<td>5</td>
</tr>
<tr>
<td>Above 400</td>
<td>6</td>
</tr>
</tbody>
</table>

Correction dose = 2 units of Novolog

Next, determine the carb dose.

71 grams of carb eaten ÷ 10 (ratio) = 7.1 (round to nearest \( \frac{1}{2} \) unit) = 7 unit carb dose

Finally, determine the total # of units of Novolog needed for lunch.

2 units (correction dose) + 7 units (carb dose) = 9 units (total units of Novolog needed for lunch)

---

**Other examples**

Pre-lunch blood sugar is 287 and 59 grams of carbs were eaten.

**Correction dose:** 287 blood sugar range = 3 units (on correction scale)

**Carb dose:** \( 59 \div 10 = 5.9 \) (round to nearest \( \frac{1}{2} \)) = 6 units

**Total units of Novolog:** 3 units + 6 units = 9 units

Pre-dinner blood sugar is 144 and 85 carbs were eaten.

**Correction dose:** 144 blood sugar range = 0 units (on correction scale)

**Carb dose:** \( 85 \div 10 = 8.5 \) (round to nearest \( \frac{1}{2} \)) = 8.5 units

**Total units of Novolog:** 0 units + 8.5 units = 8.5 units
other factors to consider for determining the Novolog dose

<table>
<thead>
<tr>
<th>Activity level</th>
<th>Example of activity</th>
<th>Round up or down?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactive</td>
<td>Being in school</td>
<td>Round the dose up</td>
</tr>
<tr>
<td>Active</td>
<td>Playing outside</td>
<td>Round down, or even pre-treat for activity</td>
</tr>
</tbody>
</table>

What will your child’s activity level be after the meal?

schedule for meal times

Novolog meal doses can be given either right before or after the meal. While in the hospital, children will be receiving their Novolog after meals. Physicians will be determining their doses.

- Older children: School age or older will need to give the Novolog just prior to the meal.
  - By giving the Novolog just prior to the meal, the blood sugars will not go as high after eating. This results in better blood sugar control.

- Younger children: For younger children, Novolog needs to be given within 30–40 minutes from the time your child starts eating.
  - Younger children are given their insulin right after eating due to the child not being able to tell what they are going to eat specifically. If the Novolog was given before and the child does not eat the full carb amount, this will put them at risk of low blood sugars.
  - Once younger children are able to tell what they are going to eat at meals, the Novolog dose should be given before the meals.

Ensure proper calculation:

Correction dose + Carb dose = Total Novolog dose

insulin syringes or shots

using syringes

Insulin must be given with insulin syringes as these syringes are made specifically for giving insulin. Using other types of syringes may result in the wrong amount of insulin being given.

- There are three (3) sizes of insulin syringes. The smaller syringes are marked in either one unit or ½ unit amounts.
  - Note: The needle size and length for all the syringes is the same. They just differ in the amount of insulin they hold.
  - 3/10 cc syringe – can hold up to 30 units
  - ½ cc syringe – can hold up to 50 units
  - 1 cc syringe – can hold up to 100 units

- Insulin syringes that are prescribed have either short or mini needle length. Make sure that the pharmacy provides insulin syringes with the correct needle length.

rotation of insulin injections

- Insulin is injected into the fatty areas just under the skin in the arms, abdomen, thighs, and buttocks. Injections for these areas of the body are known as “subcutaneous” injections.

- Rotating sites means following a pattern as you move your injections around from site to site. Every person’s pattern may be different.

- Insulin enters the blood:
  - Fastest from the abdomen
  - A little slower from the arms
  - Even more slowly from the legs
  - Most slowly from the hip/buttocks
  - Note: You may want to use an area at a certain time because of its absorption rate.

- Do not give your injection in the same spot everyday! This can cause lumps and hard places under the skin (hypertrophy). Hypertrophy or scar tissue causes insulin not to be absorbed correctly.

- It is recommended to use all sites in one location, keeping injections approximately ½ inch apart. Jumping from site to site makes it difficult to remember where the last injection was given. You may choose to have all your morning injections in the belly, all afternoon in the arm and all bedtime injections in the hip or leg.

- Don’t inject too closely to scars, bruises, belly buttons or moles. Stay away from the inner thighs – rubbing between the legs can make the injection site sore.

- Use the entire site area for injections, such as the top and outer aspect of the leg.
7 easy steps to drawing up a single type of insulin

1. Wash your hands with soap and water, then gather supplies: syringe, alcohol, swab, insulin and doses.

2. Wipe off the top of the insulin bottle with an alcohol swab.

3. Pull the plunger down to pull air into the syringe. You will need the same number of units of air as the number of units of insulin that you are going to withdraw. This is important because if you skip this step, the air pressure in the bottle will change enough that it will make it hard to draw insulin out of the bottle.

4. Push the needle into the bottle.

5. Push the plunger so that the air goes into the bottle.

6. Turn the insulin bottle over with the needle still inside it (so the syringe is under the bottle).

7. Pull plunger down to the number of units needed at that time.

caution

Make sure of which insulin you are preparing. Giving the wrong insulin can greatly affect blood sugars. Call the diabetes team immediately if the wrong type of insulin is given.

steps for insulin injection

1. Gather needed supplies: syringe filled with correct amount of insulin and alcohol swab.

2. Choose an injection site. Remember, insulin is absorbed best from (in order):
   - Abdomen
   - Arm
   - Thigh
   - Hip

3. Clean skin at site with an alcohol swab. Let alcohol dry.

4. Bunch up a large area of skin with one hand.

5. Hold your syringe like a dart or pencil with the opposite hand.

6. Push the needle all the way into the skin, going straight in at a 90 degree angle. Be sure the needle is all the way in.

7. Use a finger to push the plunger all the way down. This will push the insulin into the body. Leave the needle under the skin for three seconds.

8. Pull the needle straight out of your skin. Do not rub the place where the injection was given. Check the area for any redness, bleeding or bruising.

9. Safely dispose of used needles and syringes. See the next section for instructions on how to do this.

10. Some restaurants and airports now have “sharp containers” in their bathrooms for your use.
disposing of sharps at home

Like anything else we throw out, lancets, syringes, and pen needles need to be disposed of properly. Otherwise, they can end up in places they don’t belong, like beaches. Because they are sharp, someone could accidentally get hurt, like the person who collects your garbage, someone in your family, or even you!

steps for disposal

1. After you've checked your blood sugar or given an insulin shot, put your lancet, syringe, or pen needle directly into a strong plastic or metal container with a tight cap or lid. Do not bend, break or put the cap back on your needle... you might hurt yourself!

2. When the container is full, tightly secure the lid and reinforce it with heavy-duty tape before throwing it in the trash. Mark it “Sharps.” Be sure not to put it in the recycling bin!

container do’s

The best containers to use are those that:

• Are made of strong plastic or metal, so needles can’t poke through.

• Examples: Bleach bottles, liquid detergent bottles, coffee cans

container don’ts

• Don’t use glass containers or lightweight plastic containers.

• Don’t use any container that will be returned to a store.

• If you use a recyclable container, be sure it doesn’t end up in the recycling bin by mistake.