

Diabetes and Insulin Management



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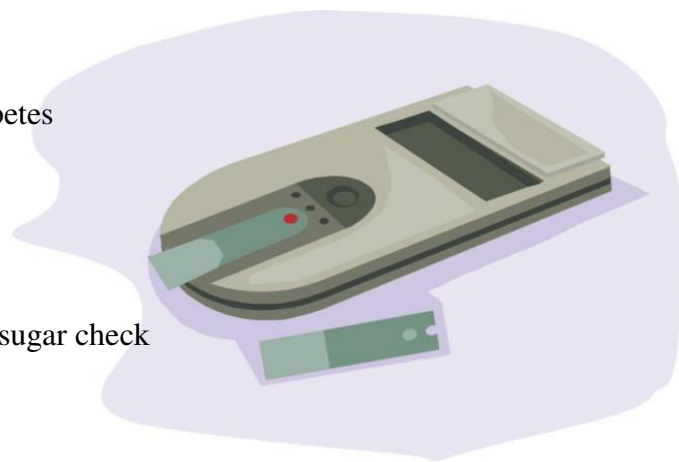
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Diabetes and Insulin Management

*This inservice is devoted to covering diabetes management in assisted living communities. It is a reproduction of that portion of the **Medication Administration** inservice which covers diabetes and insulin management.*

Diabetes is a major problem for millions of people and is a common diagnosis among residents of long term care facilities. Some diabetics control their blood sugars through diet alone. Others take oral medications. Some diabetics take insulin, normally given as a subcutaneous (into the fat) injection. Here is the outline of topics covered in this inservice:

1. Introduction
2. Types of diabetes
3. Common misconceptions about diabetes
4. Risk factors for diabetes
5. Tests for diabetes
6. Hyperglycemia
7. Hypoglycemia
8. Hypoglycemia at night
9. How to perform a fingerstick blood sugar check
10. Insulin management
11. Sliding scale insulin
12. Insulin injection sites
13. Insulin appearance and storage
14. Mixing insulin
15. Prevention and treatment of diabetic complications
16. Diabetes and infection control



Introduction

Diabetes (diabetes mellitus) can be defined by this short definition: It is a *blood sugar control problem*. It is a disease caused when the body does not produce enough insulin, or the body cannot properly use the insulin it does produce. This causes a disturbance in how carbohydrates, proteins, and fat are metabolized (burned for energy).

Insulin is a hormone produced by specialized cells within the pancreas, a finger-shaped organ about six inches long situated just behind the stomach. Insulin helps the cells in your body convert glucose (one of the simple sugars) into energy. Insulin is needed to get your cells to absorb glucose from your bloodstream. If there is not enough insulin, or if cells cannot take in glucose for some reason (insulin resistance), glucose builds up in the blood, which leads to high blood sugar.

High levels of glucose in the blood can be very hard on the blood vessels. It acts like a toxin. The imbalance and wide fluctuations in blood glucose causes blood vessels to become stiff. Plaque deposits (buildup of material on the inside of vessel walls) are more likely, leading to a

narrowing of blood vessel passageways and a decrease in blood flow. This makes it harder for the tissues of many of the body organs to get the oxygen and nutrients they need. The starved organs then begin to suffer damage.

Since the bloodstream carries blood sugars, diabetes can affect every body organ system. Strokes, heart attacks, kidney failure, digestion problems, skin breakdown, peripheral vascular disease, blindness, nerve damage, high blood pressure, and high cholesterol levels are more common in diabetics.

Some sobering statistics about diabetes

1. Diabetes is the reason for the majority of lower limb amputations, accounting for more than 60% of such amputations not caused by trauma.
2. Diabetes is the leading cause of kidney failure.
3. Diabetes contributes to nearly a quarter million deaths in the U.S. each year.
4. The risk for stroke and for death by heart disease is 2 to 4 times higher in the diabetic.
5. 2 out of 3 diabetics have high blood pressure (equal to or greater than 140/90).
6. Diabetes is the leading cause of new cases of adult blindness.
7. 60% to 70% of diabetics have some degree of damage to the nervous system.
8. Medical costs are 2.3 times higher than in patients who don't have diabetes.
9. There are nearly 26 million Americans with diabetes, about 1 in every 12 people. Approximately 1/3 of those with diabetes don't know they have it. Another sobering statistic is that there are around 79 million people who have prediabetes. This is a condition that is not true diabetes but places the patient in a high risk category and more likely to develop the disease.
10. Diabetes is more common among minority groups, such as Latinos, blacks, Americans of Indian or Asian descent, and Pacific Islanders.
11. Roughly 285 million people in the world have diabetes. This is equivalent to 2 out of every 31 adults. By the year 2030 the number of diabetics worldwide is expected to balloon to more than 438 million!
12. Diabetics in general have about 1/3 less life expectancy, so the increase in the number of diabetes cases means an increase in complications and early death.
13. Two out of three deaths in diabetic patients are related to heart disease or stroke.

Types of Diabetes

Type 1 Diabetes

Type 1 diabetes (known in the past as *juvenile* diabetes) is diagnosed in children and young adults. The pancreas produces very little or no insulin and the person must take insulin injections. Type I diabetics can have diabetes for many years, so the chances for major complications increase dramatically. Having one or more close family members with diabetes is a major risk factor for the development of this type of diabetes. It is crucial that diabetics control their blood sugar and manage their health wisely.

Type 2 Diabetes

Around 95% of diabetics are type 2. This type is diagnosed mainly in adults, but more children are showing signs of it. In type 2, the pancreas makes insulin, but either it doesn't make enough for the needs of the body, or the body's cells are resistant to the effects of insulin. As mentioned earlier, people age 65+ are 3 times more likely to develop diabetes than those age 35-64.

Common misconceptions about diabetes

There are many misconceptions and myths about diabetes. We've listed some of these, as noted below.

Most overweight people develop diabetes

Truth: Being overweight is one of the risk factors for diabetes. However, most overweight people do not develop diabetes. Most diabetics are either of normal or near normal weight.

Fruit is healthy and you should eat lots of it

Truth: Although fruit should be included in most any balanced diet, too much fruit can negatively influence blood sugar levels. Sugar is greatly concentrated in fruit juices, which should be used in moderation.

If you eat right, you should be able to control your blood sugar without insulin

Truth: Diabetes is a progressive disease for most people. Although oral meds and proper diet can at first keep blood sugars in an acceptable range, glucose levels will creep up over time and insulin supplements become more likely.

Diabetics are more likely to get infections, colds or other illnesses

Truth: Although some kinds of infections (related to decreased circulation or sensitivity to pain) are more likely, colds and illnesses in general are no more common in diabetics. But illnesses or infections that do happen can be harder to control or get rid of.

Diabetics should not eat chocolate or sweets

Truth: Chocolates and sweets can be a part of the diet of a diabetic, especially if combined with exercise and healthy eating. They do not need to be "off limits." No study that we are familiar with shows that occasional sweets cause any more harm than if the person did not have diabetes.

Diabetics should not eat many starchy foods

Truth: Starches are an important part of a balanced diet and should be included. The key is portion size. Pasta, rice, beans, corn, cereals, whole grain breads, and similar foods can be included in the diet. Many starches also contain fiber, which can be helpful for digestion.

Diabetics should eat special diabetic food

Truth: Studies have shown that special diabetic foods or diabetic diets do not usually help control diabetes. Furthermore, calorie restricting diets without accompanying weight loss do not significantly reduce blood sugar results.



Risk factors for diabetes

The exact cause of diabetes is not known. However, we do know that there are certain hereditary and lifestyle-based *risk factors* that increase the chances of someone developing diabetes. This makes certain persons more vulnerable to developing diabetes.

Risk factors make us more susceptible to a certain illness or disease. Having one, or even all, of these risk factors does not mean a person will develop the disease. It just means that the disease is more likely. Risk factors for diabetes include the following:

Obesity

Persons who are too overweight have a higher likelihood of developing type 2 diabetes. There is scientific disagreement about the significance of certain charts, scales, or ratios that try to determine the point at which excess weight compromises health. However, this much is known to be true: if your excess weight interferes with any activity of daily living (ADL) to any significant degree, you weigh too much.

Apple-shaped figure

Some overweight folks seem to put lots of their weight around the waist or upper body (apple-shaped), while others have smaller waists but large hips (pear-shaped). Those who put on most of their weight in the upper body have a greater chance of developing diabetes and heart disease. A man's waist should be less than 40 inches, while a woman's waist should be less than 38 inches.

Age

Advancing age always increases the risk of developing the risk of diabetes. Although the elderly are most likely to have diabetes, more children are developing the disease due to a variety of factors. Still, those aged 65+ are 3 times more likely than those 35-64 to develop diabetes.

Sedentary lifestyle

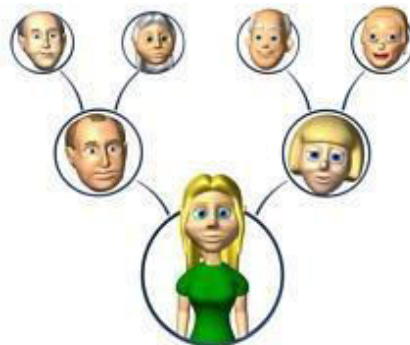
Inactivity is bad for a lot of reasons, diabetes being only one of many. Not only can increased activity and exercise improve mood and comfort, it is one of the most important controllable risk factors because it helps most of the others. Activity improves cholesterol and triglyceride levels, lowers blood sugar, blood pressure, and weight, and makes it easier to stop smoking.

Impaired glucose tolerance

A person doesn't go from being perfectly healthy to a full-blown diabetic overnight. There are often warning signs, some hidden, some more apparent. An impaired glucose tolerance (or high fasting glucose level) is one of them. A person can initially have glucose metabolism problems and not yet develop the signs and symptoms of the diabetes disease. 1 of every 10 persons with impaired glucose tolerance will have diabetes within 5 years.

Family history

Diabetes has a strong genetic component. Most people with diabetes have close relatives who also suffer from the disease. A first degree relative (father, mother, brother or sister) with type I diabetes is far more likely to have the disease. Women who have had gestational diabetes are considerably more likely to get it later in life. In fact, around 40% of such women will go on to develop diabetes usually within 5-10 years after giving birth. A baby that weighs more than 9 pounds at birth increases the risk, not just for the woman, but also for the infant, later in life.



Ethnicity

Being black, Hispanic, Latino, Asian, American Indian, a Pacific Islander, or aboriginal increases the chances of developing diabetes from 2 to 6 times.

Hypertension

About 60% of those who have diabetes but are yet undiagnosed have high blood pressure.

Hypercholesterolemia

More than 40% of diabetics have high blood cholesterol or high triglycerides levels. These higher amounts of blood lipids (fats) lead to increased risk of heart disease.

Depression

Those who are depressed are considerably more likely to develop diabetes. We know that stress can cause blood sugar levels to rise, but the mechanism behind it is not fully understood.

Insulin resistance

Cells become resistant to insulin. This means that cells don't allow insulin to transport glucose into the cells to burn as fuel. So, the pancreas has to work harder to make more insulin. This creates a complex series of effects that can lead to the development of type 2 diabetes.

Polycystic ovary syndrome

Women with polycystic ovary syndrome (PCOS) have a higher chance of developing diabetes.

Illness or infection

Some infections can cause damage to the pancreas and contribute to the onset of diabetes.

Pancreatic diseases

Illnesses or injury to the pancreas can damage its ability to make insulin and lead to diabetes.

Tests for diabetes

Fingerstick Blood Sugar

There are several common tests to help determine whether a person has diabetes, or to monitor it if it is diagnosed. A simple fingerstick blood glucose test should yield a result somewhere below 100. The normal range for blood sugar is around 74-106. This is assuming an early morning test with nothing to eat or drink for at least 8 hours prior to the test (fasting glucose test).

If the result is between 100 and 125, a diagnosis of prediabetes is likely. This means that although the person does not yet have diabetes, it is more likely later on.

If the result is greater than 125 for at least 2 consecutive mornings, the person might have diabetes. However, different glucometers vary in their "normal" value ranges. This is why a plasma (having your blood drawn instead of a simple fingerstick sample) blood glucose test is preferred to confirm or rule out diabetes. It is cheap and simple to have done.

Often, it is important to check a person's blood sugar level during the day, to see how she responds to the food she eats. If any random fingerstick blood sugar test shows a result of 200 or greater, and the person has at least one of these symptoms:

1. Increased urination,
2. Increased thirst, or
3. Unexplained weight loss...

...the person probably has diabetes.

Hemoglobin A1c

The hemoglobin A1c (HbA1c, or just A1c) is a periodic blood test frequently done on diabetics. It is usually done 2 to 4 times a year. A certain amount of glucose binds to the hemoglobin (the oxygen carrying stuff) in red blood cells. The higher the glucose levels in the blood, the more that will bind to the red blood cells.

Whereas a fingerstick blood sugar tests for the amount of blood glucose at that precise moment, the A1c measures an *average* blood sugar over the last 2-4 months. Because A1c tests give an average blood glucose level (not a “snapshot” view), it is a better indicator of a person’s overall diabetic status than the standard fingerstick test.

There are different formulas used to calculate the average blood glucose level with a known a1c level. One formula commonly used today is: $(a1c \times 28.7 - 46.7)$.

Remember that the A1c is only an average. It does not tell you whether the resident is controlled at that level or whether she has wild, daily swings (brittle diabetic). The a1c is used only as an indicator and much debate and research continues regarding optimal, high and low ranges, as well as relevance to specific diabetics.

Hyperglycemia

Hyperglycemia means “high blood sugar”. Many residents will tell you they have “high blood”. Do not assume that the resident is referring to blood sugar, since “high blood” could mean high blood *pressure*, high blood *cholesterol*, or even high blood *iron*. Some of the symptoms of high blood sugar include:

1. Polyphagia, polydipsia, polyuria
2. Fatigue
3. Weight loss
4. Blurred vision
5. Dry or itchy skin
6. Dry mouth
7. Poor wound healing
8. Recurrent or chronic infections

Polyphagia means excessive hunger. *Polydipsia* means excessive thirst. *Polyuria* means excessive urination. These are the classic signs of unrelieved hyperglycemia.

What to do...

As with any test or condition, there are degrees of hyperglycemia. If the blood sugar level is just above normal, the person will likely not show or feel any symptoms. The higher the blood sugar is, the more likely that symptoms will be present. And, treatment is more likely necessary.

In a high blood sugar condition, the goal is to bring the glucose level down. In the diabetic, this is usually done by either oral medication or insulin injection. The responsibility of the med tech is to understand signs and symptoms of high blood sugar and make sure to follow all orders and use proper technique when giving medications.

Medications can help bring down a current episode of high blood sugar. But it is important to gain long-term control. Teaching is a very important but often overlooked weapon in the arsenal of diabetes management. Make sure the resident understands what to look for when the blood sugar gets too high. Encourage the resident to be compliant with the prescribed diet, medications, and any other treatment program.



Hypoglycemia

Hypoglycemia means “low blood sugar”. As noted above, don’t assume that a person means “low blood sugar” when she says, “I’ve got low blood.” She could be talking about low blood pressure, low blood iron, or even low blood cholesterol. Diagnosis is by simple fingerstick test.

If the blood sugar is below 65, you might see some of these symptoms:

1. Sweating (very common)
2. Weakness
3. Shaking
4. Nervousness
5. Hunger
6. Nausea
7. Dizziness
8. Feeling anxious
9. Headache
10. Blurred vision

If the blood sugar is below 40, you might see some of these symptoms:

1. Difficulty concentrating
2. Confusion
3. Speaking difficulty
4. Gait or walking difficulty
5. Muscle twitching
6. Personality changes

If the blood sugar is below 20, you might see some of these life-threatening problems:

1. Seizures
2. Coma
3. Stroke
4. Death

Listen to complaints from the resident. Many long-term diabetics are acutely aware of the symptoms they tend to feel when their blood sugar drops to the point that they become symptomatic.

Remember that symptoms tend to become more pronounced as blood sugar levels fall further below normal. However, many diabetics feel very few symptoms until their blood sugar drops to dangerously low levels, since they have built up a tolerance to the symptoms. Don't rely on symptoms alone to dictate care. Understand and assess for the signs and symptoms of high and low blood sugar episodes and you will be better able to intervene with the proper care.

What to do...

As with any test or condition, there are degrees of hypoglycemia. If the blood sugar level is only a little below normal, the person might not show or feel any symptoms. The lower the blood sugar is, the more likely that symptoms will be present. And, treatment is more likely necessary.

In a low blood sugar condition, the goal is to bring the glucose level back up. Insulin is NOT given when the blood sugar is too low, because insulin makes blood sugar lower. Giving insulin to a person with a low blood sugar reading will plunge the glucose level even lower and cause severe symptoms.

The responsibility of the med tech is to understand signs and symptoms of low blood sugar and make sure to follow all orders and use proper technique when giving medications. Meds might include some form of glucose gel or tablet. Orange juice and/or sugar are often given for moderately low glucose levels. You must know and follow your facility's policy and procedure when dealing with a resident who has hypoglycemia.

Follow any doctor's orders for treating an episode of low blood sugar. Use the exact amounts of juice or sugar prescribed, if ordered. But under NO circumstance should you ever give anything by mouth if the resident is unconscious, or if their mental state is so impaired that their ability to swallow is affected. You must call for emergency help when a very low blood sugar reading occurs along with altered mental status. ALWAYS call the EMS if the resident is unconscious.

Food and medications can help bring up a current episode of hypoglycemia. But it's important to gain long-term control, especially if the resident tends to be prone to this condition. Teaching is a very important. Encourage the resident to be compliant with the prescribed diet, medications, and any other treatment program.

Make sure the resident understands what to look for when the blood sugar gets too low. People who have been diabetic for some time and have had episodes of low blood sugar quickly learn what their symptoms are. Performing a PRN fingerstick blood sugar check is a good idea for any resident who complains of having symptoms that are consistent with hypoglycemia.

Hypoglycemia at night

Diabetic residents can have low blood sugar at any time, including at night. In fact, if an early morning, fasting glucose test on a certain resident measures below 70, you can bet that the resident probably had low blood sugar for a while before you performed the test.

If a resident has low blood sugars at night, you might notice some signs and symptoms associated with it. Get a PRN fingerstick blood sugar (assuming you have orders for it) if your diabetic resident shows any of the following:

1. Restlessness
2. Waking up with a headache
3. Trying to get out of bed
4. Falling or rolling out of bed
5. Nighttime Sweating
6. Nightmares

How to perform a fingerstick to test blood glucose level

To do a fingerstick, you'll need to get together the proper supplies. Exactly what you use depends in part on the policy and procedure of your facility. Basically, you will need:

1. Gloves (always maintain infection control)
2. Glucometer (machine that actually tests the blood)
3. Test strip
4. Alcohol and cotton balls (or alcohol wipes)
5. Lancet (the needle that does the stick)
6. Lancet holder (unless using a disposable, single-use needle)

To perform a fingerstick, keep these important points in mind:

1. You must first be trained and checked off by a registered nurse.
2. Make sure you are about to test the right resident at the right time.
3. Explain to the resident what you are about to do and tell her how she can help.

Now, follow these steps:

1. Put on your gloves.
2. Select the finger (never the thumb) you want to use (be sure to rotate sites as much as possible). The best fingers to use are the two middle fingers.
3. Let the arm and hand hang in a dependent position (below the heart) for a few moments, as this improves blood circulation to the fingers.
4. Turn on the glucometer and prepare it for use.

5. Prep the finger by wiping the site with alcohol and allow it to dry completely.
6. Stick the finger using the appropriate lancet.
7. Place a sample of the blood on the correct spot on the test strip.
8. After a specified countdown time, the result will be displayed (be sure to note and record the result).
9. Clean the puncture site with a new alcohol wipe.
10. Be sure to dispose of contaminated supplies (lancet, used test strip, open/used alcohol wipes, etc.) according to policy.

Notes worth remembering:

1. Don't forget infection control measures! This includes washing your hands and wearing gloves.
2. Never stick the thumb to obtain a blood sample, due to arterial pulse.
3. Only stick the sides of the finger toward the tip—never stick the end of the finger. Nerve endings in the fingertips make it very painful and more prone to soreness.
4. The best place to stick is halfway between the side of the nail bed and the very front.
5. Do not stick the front, or fingertip *pad*, as scar tissue can develop and interfere with the sensation of touch.
6. Once the skin is punctured, do not squeeze the finger too much in an effort to *milk* out the blood, as contamination by excessive cellular or tissue fluid can cause inaccurate readings.
7. Take your time, as proper preparation helps assure you don't have to repeat the test. It also assures that you will get an accurate result.

Insulin Management

Remember from our earlier discussion that insulin is a hormone. If the body cannot make a sufficient amount of it, injections must be given to help cells take in the glucose sugar to burn as fuel. This hormone is available as a commercial preparation for those who need it.

There are several classifications of insulin, each of which you should understand in order to fully appreciate your role as a caregiver. Different types of insulin include:

1. Rapid acting (given at meal time and covers meal-related blood sugar increases)
2. Short acting (covers meals eaten within an hour)
3. Intermediate acting (covers insulin needs for roughly half the day and overnight)
4. Long acting (covers insulin needs for about a full day)
5. Premixed (usually taken two times a day, covers meals for short term needs and throughout the day)

Since there are different insulins for different needs, the doctor will order one or more types to help control the blood sugar. There are many factors that a physician must consider when deciding on what kind of insulin to order, and how much to order. Some of the questions a doctor will think about are:

1. How difficult has it been to control the diabetes?
2. Will the resident be compliant with the injections?
3. Is the resident a brittle diabetic (wild swings, hard to control)?
4. At what time(s) of the day or night does the resident have the most abnormal fingerstick blood sugar readings?
5. Is the resident compliant with other aspects of diabetes management, such as diet?
6. Does the resident need glucose control only around mealtime, or are abnormal results seen most any time?
7. How frequently is the resident willing to get finger sticks for blood sugar testing?
8. What blood sugar management goals does the physician have in mind?
9. What is the resident's age?
10. Is sliding scale insulin used?

The chart that follows on the next page shows different classes, or types, of insulin. The chart also shows:

1. Onset (how long it takes after injection to begin working)
2. Peak (number of hours after injection when the insulin's effect is the strongest)
3. Duration (how long the insulin works from time of injection)

Note: Premixed insulins are a combination of intermediate and fast insulins. Humulin 70/30, for example, is 70% Humulin N and 30% Humulin R. The first, bigger number in the percentage always refers to intermediate insulin, while the smaller number refers to faster acting insulin.

Feel free to print this handy chart as a quick reference.

Type of insulin and brand name	Onset	Peak	Duration
Rapid acting			
Humalog	15 – 30 min.	30 min. – 1½ hours	3 – 5 hours
Novolog	10 – 20 min.	40 – 50 minutes	3 – 5 hours
Short acting (regular)			
Humulin R	30 min. – 1 hour	2 – 5 hours	5 – 8 hours
Novolin R	30 min. – 1 hour	2 – 5 hours	5 – 8 hours
Velosulin BR	30 min. – 1 hour	2 – 3 hours	2 – 3 hours
Intermediate acting			
NPH (N)	1 – 2 hours	4 – 12 hours	18 – 24 hours
Lente (L)	1 – 2½ hours	3 – 10 hours	18 – 24 hours
Long acting			
Ultralente (U)	30 min – 3 hours	10 – 20 hours	20 – 36 hours
Lantus	1 – 1½ hours	Steady, no peak time	20 – 24 hours
Levemir or Detemir	1 – 2 hours	6 – 8 hours	Up to 24 hours
Premixed			
Humulin 70/30	30 min	2 – 4 hours	14 – 24 hours
Novolin 70/30	30 min.	2 – 12 hours	Up to 24 hours
Novolog 70/30	10 – 20 min.	1 – 4 hours	Up to 24 hours
Humulin 50/50	30 min.	2 – 5 hours	18 – 24 hours
Humalog 75/25	15 min.	30 min. – 2½ hrs	16 – 20 hrs

Sliding scale insulin

Sliding scale is a unique type of insulin injection schedule. Sliding scale insulin is always done in conjunction with a fingerstick blood sugar. It is not given on a routine schedule per se, but rather the amount of insulin you give is based on what the fingerstick blood sugar result is.

The doctor decides what the exact sliding scale should be. There is a lower limit for a blood sugar below which no insulin would be given, say, below 150, 175, or perhaps 200. Then, for every range beyond that, a certain amount of insulin would be given, depending on the blood sugar. The insulin type that would be used is always rapid or short acting insulin. Consider the following sliding scale example and assume BID (twice a day) blood sugar tests:



“Sliding scale regular insulin: If FSBS < 150, 0 units 151-200 give 2 units 201-250 give 4 units 251-300 give 6 units 301-350 give 8 units 351-400 give 10 units, Greater than 400 give 12 units and call MD”

So, if you did a blood sugar check in the morning and got a result of 133, you would give no sliding scale insulin. If the result was 214, you would give 4 units. If the result was 349, you’d give 8 units. Since in this example she gets an FSBS done twice a day, it is possible she would have sliding scale insulin twice a day if she always ran high. Some residents, however, are almost never high and might not ever need sliding scale coverage.

Of course, the resident might receive some sort of routine insulin in addition to their sliding scale. Some diabetic residents are on several types of insulin, so be very careful to administer all ordered insulin as scheduled.

A word of caution about sliding scale insulin: many medication errors are made when giving various amounts of insulin. The chances for errors increase when there are two sliding scales ordered, one for the daytime and one for the bedtime blood sugar check. The likelihood for errors greatly increases when the resident is on multiple routine and multiple sliding scales.

One final word: sliding scale insulin has not been shown to be any more effective than routine insulin for the majority of insulin dependent diabetics. It is usually considered to be a short term treatment, though many long-term care residents are on sliding scale coverage for years.

Insulin Injection Sites

Human skin has 3 layers—*epidermis* (the outer, thin layer), *dermis* (thicker, middle layer that contains nerve cells, blood vessels, oil and sweat glands), and *subcutaneous* (or “sq” for short—also called adipose tissue, or fat) layers. Insulin is injected into the third (subcutaneous) layer.

It is important to know where to give insulin injections, as not all sites absorb equally well. Keep these helpful points in mind:

1. Insulin can be given in virtually any part of the body where it can be given into the fat. Here's the test: can you pinch at least $\frac{1}{2}$ - 1 inch of skin? The best places are the ones with a good deposit of fat and are easily accessible. These include the abdomen (stomach), back of the upper arms, and the front and outsides of the middle thighs.
2. The same insulin is absorbed at different rates depending on where the injection is given. In most cases, insulin moves into the blood stream quicker if given in the abdomen, and a little slower if given in the upper arms or thighs.
3. Activity can affect absorption rates. To help drive down elevated blood sugars and speed up how fast insulin makes it into the blood stream, have the resident to increase activity as tolerated.
4. *Different spots for different shots!* Remember this saying. Notice that it does not say different *sites* for different shots. Contrary to popular belief, you *can* use the same general site for several injections. For example, you can use the same site, such as the back upper left arm, for, say, a week's worth of daily injections. The key is to avoid successive shots very close to the exact same spot.
5. Giving injections in the same general area can actually help stabilize blood sugars, since any similar area will have similar absorption rates.
6. Remember not to give injections too closely to the exact same spot. Giving lots of shots in nearly the same spot can, over time, cause several medical problems. A condition called *lipodystrophy* can occur. This happens when the fat under the skin is altered. The fat either thickens or disappears, otherwise known as "lumps or slumps".

Insulin appearance and storage

It is important to store insulin according to manufacturer's directions. The guide points below will give you a solid base to work from.

1. Clear insulin is insulin without additives. They work the fastest. The rapid acting and the short acting insulins are examples of the clear insulins.
2. It is additives that give cloudy insulin their cloudy appearance. The additives slow the rate of absorption.
3. Cloudy insulin should be a uniform cloudy appearance once the vial is gently mixed.
4. Discard any cloudy insulin that should be clear and any clear insulin that should be cloudy.
5. Never mix Lantus insulin with any other insulin.
6. Store insulin in the appropriate place. If vial was kept in the refrigerator, roll it in your hands 10 times or so in order to warm it before withdrawing for administration.
7. Insulin is composed of a protein dissolved in water. It will spoil after a period of time. Discard any insulin past the expiration date.
8. Never freeze insulin, as it will not work as well after thawing. Throw away any insulin that has been frozen and thawed. No exceptions.
9. Warm cloudy insulin by rolling it between your hands for a few seconds. This will also mix the insulin with the additive.

Mixing insulin

It is important to mix insulin according to manufacturer's directions. The guide points below will give you a solid base to work from.

1. If you must mix insulin, always draw up the clear before the cloudy, as you do not want to contaminate the clear vials with the cloudy.
2. "Clear" insulins are the rapid and the short acting ones, while the "cloudy" insulins are the long acting ones.
3. Never mix Lantus insulin with any other insulin.
4. Always inject air into insulin vials before withdrawing insulin. If you don't, repeated withdrawing of insulin without first injecting air will create a vacuum, which, after a time, will make it very difficult to draw out the insulin, because the vacuum will create a strong suction.
5. Inject air into the insulin vials equal to the amount of insulin to be withdrawn. If you are to remove 10 units, inject 10 units of air first. This will equalize pressure. Once you insert the needle, tilt the vial upside down so that the insulin goes toward the needle while the air floats to the top.

The above points serve as a good background to mixing insulin. Now, follow these steps. Let's assume that you are giving 4 units of regular insulin to be mixed with 20 units of NPH insulin.

1. Wipe the tops of both vials with a fresh alcohol pad.
2. Pull back the plunger on the insulin syringe to the 20 unit mark.
3. Insert the needle into the NPH vial and inject the 20 units of air into it.
4. Pull out the needle without drawing up any insulin and set the vial aside for now.
5. Pull back the plunger on the syringe to the 4 unit mark.
6. Insert the needle into the regular insulin vial and inject the 4 units of air into it.
7. Tilt the vial upside down to get the insulin to flow to the needle.
8. Slowly withdraw 4 units of insulin from the regular insulin vial.
9. Pull out the needle and set aside the vial.
10. Insert the needle into the NPH vial and turn upside down.
11. Pull back on the plunger to withdraw 20 units of NPH insulin into the syringe.
12. **IMPORTANT:** You will go from 4 units (from the regular insulin already in the syringe) to the 24 unit mark, once you get 20 units of NPH into the syringe, so you will have 24 units in the syringe altogether.

Special considerations in the elderly resident

The elderly pose several challenges when managing diabetes. This is due to such issues as normal aging changes, increasing use of multiple medications, normal declining functional and mental capabilities, social problems, decreased exercise tolerance, presence of other acute or chronic diseases, and so on. Keeping the following special notes about the diabetic elderly in mind will help improve your care managing:

1. Around half of type 2 diabetics are over the age of 60.
2. Diabetic elderly residents are more likely to be incontinent.
3. It is harder for them to feel thirsty and easier to become dehydrated.
4. Residents with diabetes show poorer functional abilities, leading to higher risk of falls, one of the leading causes of injury in long term care facilities.
5. High blood sugar can affect cognitive (mental) functioning, increasing the chances for non-compliance.
6. Diabetics tend to be more depressed.
7. Elderly diabetics are more likely to get pressure ulcers.
8. 2/3 of amputations happen to people past the age of 65 and about 2/3 of those amputations are diabetics.
9. The elderly diabetic is more likely to contract tuberculosis.
10. Diabetes contributes to eye problems: cataracts, glaucoma, retinopathy, blindness.
11. Most of the elderly with diabetes are not seriously overweight.
12. Amazingly, calorie-restricting, diabetic diets have *not* been shown to significantly improve an elderly resident's blood sugars.
13. Diabetics have a lower pain threshold; that is, they feel pain more strongly.
14. Neuropathy pain (usually in the lower extremities caused by nerve damage) is the *most common chronic complaint* of the elderly diabetic.
15. There is no "best" form of insulin for use in the elderly. Residents who need insulin are not usually well-controlled with a single, daily dose of intermediate acting insulin

Prevention and treatment of diabetic complications

We have already mentioned that diabetes affects every body organ system. This is because excessive glucose, which is carried by the blood stream, affects the circulation vessels. This in turn reduces the amount of nutrition and oxygen the organs can receive.

It cannot be overstated that diabetic residents have to be carefully monitored in order to avoid, or at least minimize, diabetic complications. Careful monitoring, reporting, and documentation of a resident's diabetic status can greatly benefit the resident. Some of these benefits include:

1. Less pain
2. Reduced cost
3. Fewer trips to the hospital
4. Overall better quality of life
5. Preventing some complications from happening

6. Earlier recognition of complications that arise
7. Earlier treatment for complications
8. Slowing down diabetes disease progression
9. Decrease in the number and severity of high or low blood sugar events
10. Decrease in infections, dehydration, and electrolyte imbalances

There are several things you can do that will make a real difference in the quality of life for those who suffer from diabetes. One of the easiest, yet most neglected, things is just listening to them. Take seriously their complaints of pain. Evaluate any new wound, their state of mind, or signs and symptoms of an infection.

Pay attention to your senses when you give personal care. Do you see, hear, smell, or feel anything out of the ordinary? Does the breath smell fruity sweet? Is the skin dry and flaky? Is there a rash or wound you haven't seen before? Is there a discolored spot on a toe or foot? Do the toenails need trimming (an often overlooked point of care in assisted living facilities)?

You know your residents in some ways perhaps better than anyone else. If you care for a resident long enough, you will have a good feel as to what their normal state of health is. Use your knowledge of their usual disposition to your advantage. Does she sleep more than usual? Is she tired more recently? Does she complain of feeling down and lacking in energy? Is she more "moody" lately? Has she become irritable or hostile? Is she diet compliant? Is she noncompliant with any part of the prescribed treatment plan?

Take advantage of your personal care skills when you care for residents who have diabetes. Below you will see several areas of personal care. Each area has several guidelines on how to prevent or treat complications of diabetes.

Foot care

1. Observe feet daily for wounds, sores, redness, need for nail care
2. Dressings or other treatment may be needed for ulcerations
3. Skilled nursing care may be needed for moderate or severe ulcerations
4. Residents generally should not trim their own toenails
5. Toenails can be trimmed only by a podiatrist (foot doctor) or a registered nurse
6. Daily foot care as needed
7. Compliance with compression stockings (TED hose) as ordered
8. Comfortable, soft shoes—nothing that will bind or restrict circulation
9. Give foot care as appropriate, including lotion, bathing, etc.

Eye care

1. Make sure residents comply with eye doctor appointments
2. Routine eye exams are necessary, as the eyes are among the first place to reveal a problem with circulation
3. Diabetes can lead to glaucoma, retinopathy (disease in the retina), and macular edema (fluid leaking from tiny blood vessels in part of the retina in the back of the eye ball)

4. Diabetes is the major cause of blindness in the U.S.
5. Controlling blood sugar and blood pressure is essential to good eye care
6. Report complaints of decreased or hazy vision
7. Report any signs of an eye infection

Oral care

1. Note any mouth sores, pain, tooth, or chewing problems
2. Oral care is one of the most neglected personal care areas—make sure oral care is done daily and assist if resident cannot do own oral care
3. Make sure resident keeps dental appointments
4. Note any new orders you are likely to see following dental/oral surgery
5. Encourage resident to wear her dentures, if applicable
6. Monitor appetite and intake
7. Observe swallowing ability

Controlling blood pressure

1. Blood pressure control is vital to lessening the destructive effects of diabetes
2. BP meds must be given faithfully as ordered
3. Routine vital signs are often neglected—be sure to take BP as ordered and document in designated places

Managing diabetic neuropathy

1. Neuropathy is nerve damage—diabetic neuropathy is nerve damage caused by diabetes
2. Roughly 60% of diabetics suffer from some form of neuropathy
3. Neuropathy often causes pain, depending on the nerves that are actually damaged
4. Routine pain meds should be given as ordered
5. PRN pain meds should be given as ordered when routine pain meds are insufficient
6. Neurontin is often the drug of choice in helping control neuropathy pain
7. Be serious about pain management and report to MD if pain is not well-controlled

Controlling lipidemia

1. Lipids are fats and too much of it interferes with glucose metabolism
2. Give lipid-lowering, cholesterol-lowering meds as ordered
3. Make sure labs are done according to ordered schedule
4. Frail, elderly residents generally should NOT have dietary fat restrictions

Managing cardiovascular disease

1. Note and report any complaints of chest pain, shortness of breath, congestion, or unstable/abnormal vital signs

2. Take vital signs as ordered and PRN
3. Make sure resident receives all meds as ordered
4. If nitroglycerin tablets are ordered, be sure to take a baseline BP before administering the first tablet (under the tongue—*sublingual*) and a BP before each additional tablet
5. Learn CPR and keep up-to-date on changes in CPR techniques

Managing nephropathy

1. *Nephro* refers to the kidney, so *nephropathy* refers to kidney disease
2. BUN and creatinine are two common tests used to help determine kidney function—high results in both these tests might mean kidney damage or disease
3. Observe color of urine as able and document
4. Residents with kidney disease generally should not eat a high protein diet
5. Controlling glucose levels and blood pressure will go far in limiting the damage to body organ systems caused by diabetes

Diabetes and infection control

Although we've covered infection control in general earlier in this inservice, diabetic management brings up new challenges. The risk of transmitting a blood-borne pathogen through the use of equipment in obtaining fingerstick blood sugar readings or in giving insulin is often underappreciated.

The blood-borne pathogens that are the greatest concern to most healthcare workers are hepatitis B virus (HBV), hepatitis C (HCV), and HIV (virus that causes AIDS). It has been estimated that there have been at least fifteen outbreaks of the hepatitis B virus over the last ten years due to noncompliance with proper med administration techniques. It is likely that the number is higher than fifteen, due to underreporting and not recognizing the nature of the outbreak. Most of the outbreaks occur in long-term care facilities.

How are blood-borne viruses transmitted from one person to another? There are several circumstances that contribute to this:

1. Not washing or sanitizing your hands
2. Not wearing gloves or not changing gloves between residents
3. Using the same insulin syringe or pens among different residents
4. Using the same fingerstick or puncture device among different residents
5. Using the same glucose meter among different residents or failing to properly disinfect the machine before using it on the next resident

Let's take a look at each of these more closely.

Wash your hands!

The first rule of infection control when you are about to perform a fingerstick or give insulin is to

wash your hands. In some situations it may be acceptable to use a hand sanitizer, but there should always be some form of hand hygiene. Policy on infection control in the facility in which you work will address this.

Best practice rule: Always practice some form of hand hygiene before providing care to each and every resident.

Wear gloves!

Many med techs make the mistake of not changing gloves between residents. It is good to serve up a reminder at this point that infection control is a two way street. You don't want an infection, but you also don't want to give one to someone else. Even a microscopic amount of body fluid from a resident on your gloves, if introduced into the puncture wound you create on the next resident, could cause the illness that your gloves were designed to help prevent.

Best practice rule: Immediately after completing diabetic care, remove your gloves and sanitize or wash your hands.

Do not use the same syringe among different residents!

Insulin syringes and pens are used as the vehicle for getting the insulin into the resident. This is done by puncturing the skin with a needle. A standard insulin syringe is used to puncture a bottle of insulin, extract the exact amount of insulin needed, then administered to the resident.

An insulin pen is manufactured as a safe alternative to using multiple syringes. One pen is used for one resident, with the needle being changed before each dose. The same pen can be used for multiple shots until the cartridge or reservoir is empty.

A used syringe or needle is contaminated with the blood of the previous user. Many infections and deaths can be traced to sharing syringes.

Best practice rule: Never use injection equipment for more than one person. Insulin syringes should be discarded immediately after use in the proper sharps container. Needles used for pens must be removed and properly discarded immediately after use.

Do not use the same puncture device or needle between different residents!

There are two major types of lancet holders or needle puncture devices: single use and reusable. Single use needles are disposable. They have an auto-disabling feature that prevents you from reusing the same needle again. It should make sense that these are the safer of the two types.

Reusable needle holders, also called lancet holders, are devices that can be used multiple times. A new needle (lancet) is loaded into the device when a fingerstick is to be done. The problem with this kind of instrument is that it must be cleaned right after each use.

First, the needle must be removed and properly discarded. Then, the end cap or any disposable

portion must be cleaned or changed. This type of device has been implicated in the spread of blood-borne viruses due to improper care and cleaning. Because of this, reusable needle holders should never be used among different residents.

Best practice rule: Use a single use needle to perform a fingerstick for blood sugar checks. Don't use fingerstick equipment for more than one resident.

Residents should have their own blood glucose meters!

The glucometer, or blood glucose meter, is the device used to test the blood for glucose concentration. There is a very real risk of transmitting a virus from an infected resident to another when using the same machine that has not been properly disinfected. Follow the manufacturer's directions for proper maintenance and cleaning. If the manufacturer does not give directions for cleaning and disinfecting the machine, it should not be shared among residents.

Best practice rule: When possible, do not share glucometers. If more than one resident shares the same blood glucose meter, the machine must be cleaned and disinfected after each use.

Don't forget to take the test and submit the test (along with the Verification form) back to us for your CEU credits!