

Diabetes Mellitus

Also called Diabetes, Type I & II Diabetes

Description of the Disability

Diabetes Mellitus is a metabolic disorder involving a problem with a hormone called insulin. These problems cause a dramatic increase in a type sugar called glucose in the person's bloodstream and body. The words in the name Diabetes Mellitus are Latin for "passing through" (diabetes) and "sweetened with honey" (mellitus). This refers to the sweet smell and taste of the person's urine from the excess glucose. During the Middle Ages doctors would diagnose diabetes by tasting patient's urine for sweetness.

The glucose in your blood starts out in your digestive system, where your body converts much of what you eat (the carbohydrates) into the sugar glucose. Your bloodstream delivers the glucose to your body's cells so the cells can use it as an energy source. Insulin helps the glucose pass into your cells from the blood so that the cells can use the glucose. In most people, the levels of glucose in the bloodstream go up and down many times throughout the day as they eat, exercise, rest, snack, etc. The insulin producing cells in your pancreas closely monitor these changes and adjust the level of insulin in your blood to match what is happening with the glucose, smoothing out the peaks and valleys of glucose concentration and keeping your cells "fed" as needed for your activity level. If your body does not produce enough insulin or if the cells can't use the insulin correctly, the cells begin to starve. Many of the initial medical and functional problems with diabetes come from this cell starvation. Researchers do not know what causes diabetes, but they suspect the main cause is a combination of genetic and environmental factors.

When a person has undiagnosed diabetes, the initial symptoms that they usually notice include excessive thirst, frequent urination, weight loss, and fatigue. As the glucose builds up in your bloodstream, the kidneys start to excrete the excess into your urine. To handle the workload, you have to urinate frequently, which makes you thirsty. Meanwhile, your cells are starving so they begin to process reserves of fat and proteins stored in muscles as an emergency alternative. You begin to lose weight dramatically and feel tired all the time. Some of the waste byproducts of processing fat and protein for cell energy are acids called "Ketones." Ordinarily your body could process and filter the ketones out of the blood, but the large amounts being produced in diabetes can build up in your blood, changing your pH balance and sending you into a coma. This is called **Diabetic Ketoacidosis** and it requires immediate medical attention. Other possible symptoms of undiagnosed diabetes include blurred vision (caused by changes in the lens of the eye because of changing glucose levels), irritability, nausea, and vomiting. After a person has been diagnosed with diabetes and has the condition "under control", they experience other symptoms as side-effects of the process of artificially maintaining their blood sugar level. These symptoms are discussed below under "Complications and Co-existing Conditions". However, the person can also continue to experience the initial symptoms just described if or when their blood sugar rises too high.

The two main types of diabetes are simply called type I and II.

Type I (formerly called Insulin-Dependent Diabetes Mellitus and Juvenile-Onset Diabetes). In Type I Diabetes a person's body does not produce insulin or produces it in very small amounts. The symptoms usually appear suddenly during childhood, usually around the age of puberty. One theory about the cause of type I diabetes is that the immune system attacks the insulin producing cells (called "islets") in the pancreas, making this an autoimmune disease.

Type II (formerly called Non-Insulin Dependent Diabetes Mellitus and Adult-Onset Diabetes) In Type II Diabetes, both the body's ability to produce insulin and to use insulin may change. The pancreas may start producing only very small amounts of insulin or the cells of the body may become resistant to the action of the insulin. The symptoms usually develop gradually over several years and the person may not realize they are ill for quite a while. Those symptoms include increased infections or skin sores, slow healing of infections, tiredness, and tingling or numbness of hands or feet. There is a strong relationship between obesity and type II diabetes. Type II diabetes usually develops after age 45, but instances in younger people are increasing as obesity rates increase.

In both types of diabetes, the main treatment (discussed below) involves trying to artificially maintain "normal" or effective levels of glucose and insulin in the person's body. This can be very difficult because so many things affect the glucose level in the blood. Different types of food from the same meal will digest at different rates - some quickly, some very slowly - and yield different amounts of glucose. The glucose consequences of a meal can last several hours, with various peaks and valleys. In the meantime, the person will be moving and exercising in various ways, increasing the demand for glucose in the cells. People with diabetes must be aware of all of these factors.

Other Types of Diabetes

- **Gestational Diabetes Mellitus (GDM)** - This is a diabetic condition that some women experience in the second half of their pregnancy when blood sugar levels become abnormally high. The condition usually goes away after the pregnancy but in some people it does not.
- **Impaired Glucose Tolerance (Glucose Intolerance)** - These individuals have higher than usual blood sugar levels, but below the level of someone with diabetes. Usually this condition does not affect functions of daily life but it may signal the beginnings of diabetes if not controlled.
- **Diabetes Insipidus** - This is a disease of the pituitary gland that is sometimes called "water diabetes." It is not diabetes mellitus and the only things they have in common are symptoms of excessive thirst and frequent urination.

Complications & Coexisting Conditions

For a person with diabetes, preventing and managing the potential complications is a major aspect of their life. Diabetes has several complications that can become life threatening if the person and their physician cannot control them. Other complications can lead to significant functional problems such as blindness, frequent infection, or loss of limbs. It is important to understand that keeping diabetes "under control" is harder for some people than for others and

may have nothing to do with whether someone is “lazy” or “irresponsible”. Artificially maintaining a good balance of glucose and insulin in a person’s body can be a very difficult balancing act and some people’s bodies fluctuate more easily than others.

High Blood Pressure - High levels of sugar in the blood can damage the walls of the blood vessels. In addition, people with diabetes can have increased cholesterol, which also clogs blood vessels. Both of these situations can lead to high blood pressure. When blood vessels are damaged, they do not efficiently deliver blood to various part of the body and the heart must pump harder to keep the blood flowing. A person’s hands and feet can become painful if they are not receiving enough blood. Stroke happens when part of the brain is not getting enough blood.

Neuropathy (pronounced “nur-ROP-a-thee”) is a disease of the nervous system that causes numbness, tingling, pain, and an inability to feel heat or cold. High blood sugar levels can damage the outer covering of nerves. When this happens, the nerves may stop sending messages, send them too slowly, or send them at the wrong time. In addition, if blood vessels supplying the nerves are damaged, the nerves will not get enough oxygen, which further damages them. **Peripheral Neuropathy** usually starts in the feet and legs, although the hands and arms may be affected too. Eventually nerve damage can cause changes in the shape of feet as the muscles and tendons weaken from inactivity. The person may need to wear special shoes. **Proximal Neuropathy** is similar but involves the thighs, hips, and buttocks. **Autonomic Neuropathy** (damage to the autonomic nerves - the involuntary nerve system that helps you regulate body functions like heartbeat and breathing) can make it difficult for people to realize when their blood sugar is low. It can also cause problems with digestive and reproductive systems. The person may have difficulty knowing when his or her bladder is full or empty. This, in turn, can lead to more bladder infections. Damaged autonomic nerves can also cause problems with heartbeat and the blood vessels that keep blood pressure steady. When they are damaged, the person may get dizzy from sudden blood pressure changes when exercising or when standing up quickly. **Focal Neuropathy** is the sudden weakness or irritation of one nerve or group of nerves and can happen anywhere in the body. (See the Handbook entry on Chronic Pain.)

Slow Healing, Skin Damage and Amputation - The combination of reduced blood flow and reduced sensitivity to heat, cold, or pain increased the risk of injury to the skin. These injuries can easily become infected before the person is aware there is a problem, especially since high blood sugar can promote the growth of various germs. In general, the bodies of people with diabetes heal more slowly from cuts, blisters, infections, etc. If an infection becomes serious enough, the tissues involved will start to die and gangrene can set in. In many cases, the problems lead to amputation of toes, fingers, or limbs. (See the Handbook entry on Amputation for possible functional issues.)

Hypoglycemia occurs when a person’s blood sugar gets too low. This can happen for many reasons, however, the most common is a complication with regulation of insulin level. If there gets to be too much insulin in the blood than the body needs for the available food, an “**Insulin Reaction**” happens as the blood sugar drops. The person may feel cranky, hungry, confused or sweaty. Seizures are also possible during an insulin reaction. Eating sugar will usually help as a quick fix and many people with diabetes carry glucose tablets to handle this. **Insulin Shock**

happens when the blood sugar drops very quickly and unexpectedly. This is a very serious condition that can lead to coma or death if the person isn't able to reverse it in time. If a person is not able to ingest sugar in time, they may pass out. Many people with diabetes carry a **Glucogen Shot** (a hypodermic filled with glucose) to rapidly increase blood sugar levels in case of insulin shock. If the person passes out and no glucogen shot is available, emergency medical personnel should be called. As mentioned above, it is important to understand that insulin shock is more likely in some people than in others because of differences in body chemistry. Some people who are very vigilant about monitoring their blood sugar still experience occasional insulin shock without warning, while others never do. In addition, some people's hypoglycemic "threshold" (the blood level at which they become conscious of a developing problem) will drop over time. This "**hypoglycemic unawareness**" means that they will be much closer to impending insulin shock (i.e., have lower blood sugar) before they realize anything is going on and can take action. This increases the likelihood of insulin shock even if the person is very careful about their routine and treatment.

Hyperglycemia occurs when a person's blood sugar levels are too high ("hyper-" means high, "hypo-" means low). Although hyperglycemia is not a good situation, it is not as dangerous as hypoglycemia and insulin shock. A person experiencing hyperglycemia may feel very thirsty, have to urinate often, have blurred vision, feel fatigued, and in some cases may vomit or experience weight loss. Possible causes of hyperglycemia include overeating, inactivity, stress, illness, and poor control of insulin levels.

Vision Problems - People with diabetes have an increased risk of eye disorders such as glaucoma and cataracts. Physicians can treat most of these disorders successfully and correct the person's vision. **Retinopathy** (damage to the retina) can occur when high blood sugar damages the small sensitive blood vessels in the back of the eye. Over time, the damaged blood vessels may leak fluids onto the macula (the part of the eye which helps us to see detail), which blurs the person's vision. If this process progresses, new blood vessels may grow along the retina and through the clear fluid of the eye. These blood vessels are fragile and may leak blood, which can further cloud vision or produce spots. This is a serious condition that can lead to blindness if not controlled. Usually retina specialists can treat the retinopathy with laser treatments that delicately burn and seal off the new blood vessels, although this process will slightly damage the person's vision as well. (See the handbook entry on Blindness and Low Vision for functional issues.)

Kidney Disease (Nephropathy) - The excess glucose in the blood of people with diabetes can begin to overload the parts of the kidney that filter the blood. Although it is counter-intuitive, the effect of this is that more things (important proteins, sugars) get removed from the blood than should be and end up in the urine. Albumin is one of the proteins that doctors look for as a sign of this overload, and they use the term **Microalbuminuria** for the early, low-level increase in albumin in the urine. If the damage to the kidneys continues, they may reach the stage of Proteinuria (also called clinical albuminuria" or "overt diabetic nephropathy") when the waste products creatinine and urea can begin to build up in the blood. Most people with diabetes-related kidney disease will not experience significant functional symptoms (fatigue, numbness, etc.) for many years, if ever. Symptoms usually begin when the kidneys are reduced to around 10% of their normal capacity.

Poor Concentration - People with diabetes report that they have significant problems with concentration when their blood sugar is either too low or too high. The effect is a kind of "Brain Fog" that can interfere with work or activities of daily living. They have difficulty keeping their attention focused, making decisions, and just "thinking straight". Usually the problem only lasts for a short period until they are able to adjust their blood sugar, but the person may not be able to predict when it will happen or for how long.

Incidence Statistics

- ***People with diabetes have a family history of diabetes, and are of African American, Hispanic and Native American descent***
- Type II diabetes is most common in people who are overweight, are over the age of 45,
- Type I diabetes is more common in whites than in non-whites.
- About 16 million people in the United States have diabetes
- About 193,000 people die from diabetes related complications every year
- 90 to 95% of people with diabetes have type II
- About 80% of people with type II diabetes are significantly overweight
- Among disease-caused deaths, diabetes is the 7th leading cause
- Diabetes is the leading cause of blindness in people aged 20-74
- About 40% of all new cases of end stage renal failure are caused by diabetes
- 30% of all diabetes-related kidney disease is caused by type I diabetes, although it is only 5 - 10% of all diabetes cases
- 50% of people with type I diabetes develop kidney disease by age 50
- Cardiovascular disease is the leading cause of death for people with diabetes
- 50% of people with diabetes have a neuropathy
- People with diabetes are 40% more likely to have glaucoma and 60% more likely to develop cataracts.
- 10% of people with type II diabetes can control it with diet and exercise alone. 50% can control it with oral insulin. 40% need insulin injections.

Common Treatments, Medications, and Side Effects

The primary treatment of diabetes involves monitoring and controlling blood glucose levels and preventing complications. Regular exercise and a consistent diet can be helpful, allowing predictable daily peaks and lows in blood glucose and insulin needs. However, there is no simple formula to follow. Factors such as illness, stress, and unusual activity level can change blood sugar levels in unexpected ways. In addition, the sugar from various foods is absorbed at

different rates. People with diabetes must learn a lot about how their bodies react to certain foods and other activities so they can plan ahead and adjust their routine.

People with Type I diabetes must take insulin. Most people taking insulin use a hypodermic injections, however there are other devices for delivering insulin. These include insulin pens (similar to a pre-packaged hypodermic), "needleless injectors" (which inject insulin with a small, powerful blast of air instead of with a needle), and insulin pumps (similar to a portable, wearable IV drip bag, that is about the size & shape of a pager). Each method has both advantages and disadvantages for the person, but all involve periodic monitoring of blood sugar level by pricking the skin and drawing a drop of blood several times a day. Many people believe that people taking insulin get accustomed to the injections and don't mind it after a while, but this is not true. People taking insulin injections hate sticking needles in themselves as much as anyone else, but it is what they have to do to stay alive. Activity, diet and other health disorders can influence the number of injections a person must take per day.

Anyone with diabetes may experience an insulin reaction - a sudden drop in blood sugar (described above). If this happens, they must immediately ingest sugar in the form of juice, candy, or glucose tablets -if they do not, they can slip into a coma and die. This is a life-threatening situation requiring immediate attention. Signs to look for include non-responsiveness, shakiness, incoherence, and excessive emotionality.

For people with Type II diabetes, the first treatment is usually weight reduction through a low-fat diet with a variety of carbohydrates to prevent glucose levels from rising too quickly after meals. In addition, exercise helps cells to absorb glucose. For most people diet and exercise do not sufficiently control glucose levels and they must take an oral medication or inject insulin to adjust the body's insulin/glucose levels.

Oral diabetes medications work in several ways. Sulfonylurea and Meglitinide drugs stimulate the pancreas to produce more insulin. Biguanide and Thiazolidinedione drugs lower blood glucose levels by reducing the glucose produced in the liver and by making muscle cells more sensitive to insulin (allowing them to absorb more glucose). Alpha-glucosidase Inhibitors slow down the digestion of carbohydrates (starches & sugars) into glucose, which prevents the sudden peaks in blood glucose after a meal. Many people take combinations of these drugs and or even in combination with insulin injections. For some people a specific drug that worked well at first will working after a while and they and their physician have to try other drugs or combinations. See the Drugs entry for side effects of these drugs.

Medical researchers are working with some surgical treatments for diabetes, especially islet cell transplants to introduce new, working islet cells into the body where they can control blood sugar levels in a more natural way. So far, these treatments are relatively rare, but they may become more common in time.

People with diabetes must be very active in their treatment. They must be aware of the symptoms of insulin reaction so they can react quickly. They must also follow a healthy diet and monitor their blood sugar levels regularly. For some people, this responsibility can feel

overwhelming. If a person is having difficulty with monitoring his or her diabetes, counseling or more medical support may be useful.

Possible Functional Issues

- Fatigue
- Visual Impairment
- Acute, fluctuating, cognitive limitation
- Emotional lability
- Cognitive limitations due to stroke
- Difficulty thinking at times due to “brain fog”
- Difficulty concentrating due to pain from neuropathy
- Reduced coordination, dexterity, or mobility due to amputation
- Reduced ability to detect and prevent injury from cold, heat, etc.
- Increased vulnerability to skin infection

Also see entries on Blindness/Low Vision, Amputation, Kidney Disease, Stroke, and Heart Disease for additional possible functional issues.

Initial Interview Considerations

Initial Questions

- How easy is it for the person to control their symptoms?
- What is their normal routine for controlling their symptoms?
- How often, if ever, do they have problems controlling their symptoms? What specific problems have they had?
- What restrictions on their activities has their doctor recommended?
- When was the last time they had an episode of insulin reaction? Of insulin shock?
- How have their symptoms affected their employment?
- What problems have their symptoms caused in their home life? What do they have to do differently or not do at all?
- How good is their ability to feel textures or small objects with their fingers? To pick up small objects?
- How is their vision? Have they had any problems with it?
- How stable do they expect their vision to be over the next ten or twenty years?
- How is their blood pressure? Have they had any trouble with it in the past?

- What has their physician said about their kidneys and possible kidney disease? What timeline has the physician given them for when problems might begin?
- How long can they stand without difficulty? How long can they sit without difficulty?
- What accommodations have proven useful for them?
- What is a typical weekend like for them? What sorts of things do they do for fun?
- What situations or tasks do they find difficult, either functionally or in terms of controlling their symptoms?
- How often do they find it difficult to think or make decisions as a side effect of the diabetes?
- How often do they have physical pain from neuropathy or other side effects of the diabetes?

Initial Observations

- Does the person comment about pain or seem to be in any pain?
- Does the person have any obvious problems walking or moving?
- Does the person have any obvious problems with dexterity?
- How does the person's energy level appear? Do they seem alert and attentive?

Interview Accommodations (if any)

- Before they come to the interview, ask the person if they have any visual problems that require accommodation.
- Ask the person if they need anything to drink or eat

Possible Accommodations and Assistive Technology

- Private area to retreat to for insulin injections, recovery from insulin shock, etc.
- Job sharing
- Allow the person to switch between sitting and standing as needed
- Periodic breaks or flexible routine to accommodate fatigue, weakness, temporary problems with concentration (“brain fog”), or changes in energy level
- Education of co-workers about the behavioral aspects of insulin reaction and insulin shock
- A place to store extra food, insulin shots, etc.
- Also see accommodations listed in entries on Blindness/Low Vision, Amputation, Kidney Disease, Stroke, and Heart Disease

Career Planning Issues

- Even when someone is doing everything “right” to control diabetes, blood sugar levels can drop unexpectedly. It is important to have an employment setting that allows enough

flexibility for the person to take the time doing the things they need to in order to manage their diabetes.

- Major physical activity can cause major fluctuations in blood sugar. It may be better to avoid jobs that involve sudden, unpredictable physical activity. If physical activity is involved with the job, it should ideally be of a regular level, duration, and time of day and should allow the person time to monitor his or her blood sugar and eat or take medication afterward.
- Individuals who have neuropathy may have limited tactile discrimination (feeling textures or small objects). Careers involving these skills may require accommodations. Neuropathy can decrease the person's ability to tell when they have been injured, so it is important to consider the injury risk present in any jobs. Neuropathy can also cause chronic pain, effecting mood and concentration. The individual may need a flexible schedule or more frequent breaks to help deal with the pain.
- If the person has complications (reduced vision, reduced circulation, infections, etc.), it is likely those complications will get worse over time. It is useful to consider what additional accommodations the person may need in the future and get supports in place for that.

Emerging Issues

- Alternative ways to monitor blood glucose and deliver insulin
- Islet cell transplants and other possible cures
- Public awareness of the symptoms of insulin shock

Additional Information Resources

- Job Accommodation Network: basic information about various disabilities and possible questions to ask when considering accommodations - www.jan.wvu.edu.
- Taking Charge of Your Diabetes: Public domain book available through the CDC - www.cdc.gov/diabetes/pubs/tcyd/index.htm
- National Diabetes Alliance - www.diabetesalliance.org
- American Diabetic Association: www.diabetes.org
- Diabetes Monitor: Monitors diabetes happenings on the web - www.diabetesmonitor.com.
- National Diabetes Information Clearinghouse: diabetes.niddk.nih.gov/index.htm