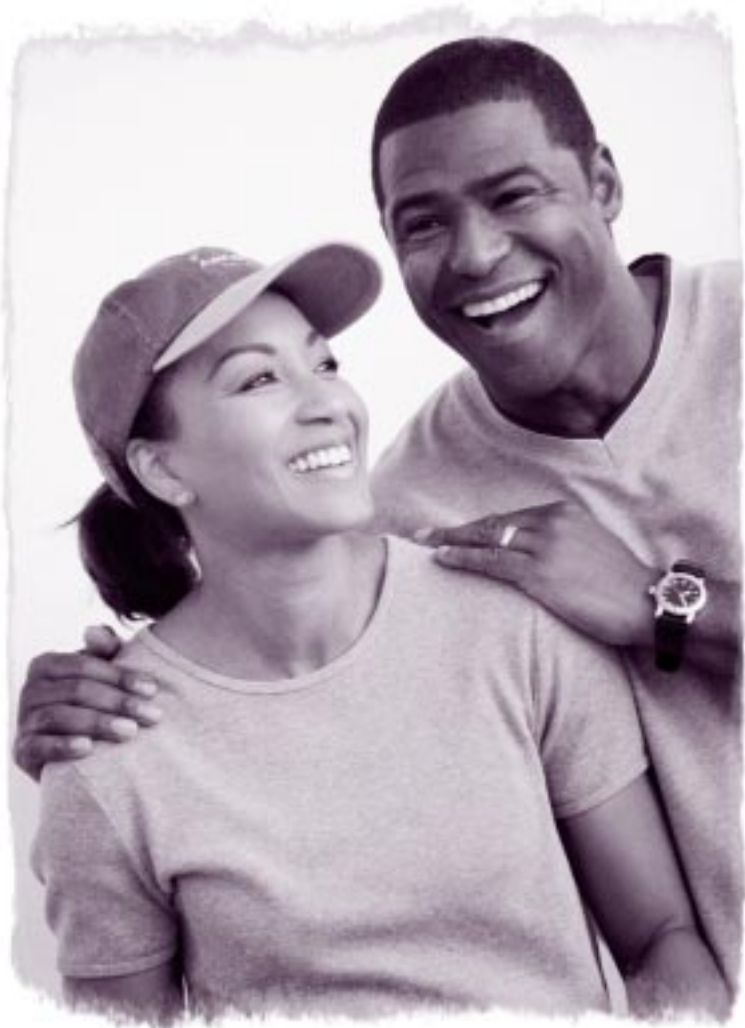


New Onset Diabetes

A Guide for Kidney Transplant Recipients



NKF National Kidney
Foundation®

Making Lives Better

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Introduction

After a successful kidney transplant, many patients without previous blood sugar problems are at risk of developing **new onset diabetes**. Recognizing signs and symptoms and becoming aware of risk factors can help recipients delay, prevent or effectively monitor new onset diabetes, also called **Post Transplant Diabetes Mellitus (PTDM)**.

National Kidney Foundation Response to a Growing Epidemic

Diabetes Mellitus (also called simply “diabetes”) is a growing epidemic and has demanded the attention of many organizations, including the National Kidney Foundation (NKF), as a national public health problem. In the United States, the number of people with diabetes is increasing at a rapid rate. An estimated 17 million people in the United States have diabetes. Unfortunately, about one third of these people do not know they have diabetes and are not receiving medical care for the condition. Each year about 798,000 people are diagnosed with diabetes. In addition, about 123,000 children and teenagers age 19 and younger have diabetes.

Transplantation is a unique risk factor for diabetes. At least 15 to 20 percent of transplant recipients are at risk for developing diabetes. The NKF is committed to developing programs that will help transplant recipients keep their donor organs and remain in optimal health after transplantation. One aspect of this commitment is to help transplant recipients recognize the symptoms of diabetes, and delay or prevent the onset of PTDM.

In May 2003, the NKF assembled a Task Force of over 60 physicians, surgeons and allied health professionals to draft a report outlining the optimal care required by a diabetic transplant recipient. This booklet will focus on one aspect of the report: preventing or reducing the impact of PTDM. The Task Force examined relevant literature and current practice in order to develop a consensus view of the special circumstances of PTDM and the care required for improved outcomes.

KEY MESSAGES on PTDM:

- Glycemic (sugar) control is important following transplantation.
- Control of high blood pressure improves donor organ survival, preserves GFR* and reduces the risk of death from cardiovascular disease in patients with diabetes.
- Modifiable risk factors (blood pressure, diet, smoking, exercise) should be assessed and managed according to existing guidelines.
- Medication selection, dosing and management can reduce or delay the onset of PTDM.

* Glomerular Filtration Rate, a way to measure kidney function

Diabetes and Transplantation

Q: What is diabetes?

The carbohydrates and fats we eat are converted into sugar (glucose). A hormone in the body, called insulin, converts glucose into energy. If your body cannot make enough insulin, or cannot use its own insulin effectively, sugar builds up in the bloodstream, causing frequent urination, thirst and health complications.

Q: As a transplant recipient, am I at risk?

Anyone can get diabetes, but some people are at increased risk. Risk factors for diabetes include having a family history of diabetes; having African American or Hispanic ethnicity; having had a Hepatitis C virus infection; being age 65 or older; being overweight; having a poor diet; not getting enough exercise; or taking immunosuppressive medications.



Q: What are the symptoms of diabetes?

- ❖ frequent urination
- ❖ excessive thirst
- ❖ extreme hunger
- ❖ extreme tiredness
- ❖ tingling or numbness in hands or feet
- ❖ sudden vision changes
- ❖ irritability
- ❖ unexpected weight loss.

Early detection and treatment of diabetes symptoms may reduce your chance of developing complications.

Q: How is diabetes diagnosed?

Even if you have no symptoms, your doctor can perform blood and screening tests. After not eating for eight hours, a blood sample is taken. This is usually done by drawing a droplet of blood from your fingertip, and testing it for glucose level. Another diagnostic test is a glucose tolerance test, which can be taken after eating. The results of these tests will show your blood glucose levels, and determine if they increase sharply when you eat. If you do NOT have diabetes, your blood glucose levels should not be greatly affected by the foods you eat, because insulin allows glucose to enter the cells of the body to be converted into energy. If you DO have diabetes, glucose builds up in the blood and passes through the kidneys, causing frequent urination and thirst.



Screening Tests for Diabetes

Fasting blood sugar (FBS): This is a measurement of blood glucose after not eating or drinking for eight hours. It is often the first test done to detect diabetes.

Random plasma glucose (RPG) test: A measurement of blood glucose taken at any time of the day without regard to time of last meal.

2-hour postprandial: A measurement of blood glucose taken two hours after a meal.

Urinalysis: A routine urine-screening test. This may be done to see whether high amounts of sugar (glucose) are present in urine. A urinalysis can also be done to help find the cause for many types of symptoms.

Q: How often should kidney transplant recipients be tested for diabetes?

It is recommended that kidney transplant recipients obtain fasting blood glucose tests according to the following post-transplant schedule:

1. At least weekly in months 1–3, then
2. At least every other week in months 4–6, then
3. At least monthly in months 6–12, then
4. At least annually thereafter

Q: What do I need to know about immunosuppression and other medications?

Unfortunately, the very immunosuppressive medications that allow the donor kidney to function in the recipient's body also produce a toxic effect on insulin production and an increased resistance to insulin. Approximately 15 percent of kidney recipients develop diabetes within a year after transplantation. If you fall into this group it is likely that you had a risk for developing diabetes prior to transplant. If a close relative has type 2 diabetes, then you are also at increased risk.

Careful selection and management of immunosuppressants is crucial to preventing diabetes in the recipient. Each transplant team and center have various protocols for treating their recipients, though the center can be expected to deviate from the protocol for the good of an individual patient. Protocols that avoid or minimize corticosteroids are becoming more common, and this is good for diabetes prevention. Higher doses of corticosteroids and the longer a recipient is taking them increase the risk for type 2 diabetes. Even a small reduction in corticosteroid dose (for example, decreasing prednisone dosage from 10 mg to 5 mg) is helpful in reducing the risk of diabetes. Calcineurin inhibitors increase the risk of diabetes as well, though it is much more difficult to provide specific recommendations for the modification of calcineurin inhibitor doses and usage.

PTDM appears more frequently in patients treated with tacrolimus than in those treated with cyclosporine. Data indicate that hyperglycemia improves in some patients after they are converted from tacrolimus to cyclosporine. African Americans, for unknown reasons, are at increased risk for developing PTDM if they are on tacrolimus, as are patients with the hepatitis C virus. Both cyclosporine and tacrolimus have a negative effect on insulin production and lowering the levels of either drug in the blood, lowers the risk for diabetes.

Other considerations for immunosuppression include:

- ❖ Mycophenolate mofetil, especially in combination with tacrolimus, could negatively impact patients with diabetic enteropathy.
- ❖ Sirolimus may negatively impact wound healing in diabetics.
- ❖ Sirolimus, calcineurin inhibitors and corticosteroids can cause or exacerbate dyslipidemia.
- ❖ Immunosuppressive regimens that do not include steroids require careful monitoring because higher doses of other medications such as calcineurin inhibitors and sirolimus are often required, and these medications may adversely affect glycemic control, cardiovascular risk and islet cell function.

- ❖ When steroid doses are raised to treat or prevent rejection, blood glucose levels and insulin dosing must be carefully monitored since these high doses of steroids alter glycemic control.

Your individual transplant team and physicians will weigh the risks and benefits of different protocols and work with you to find the best combination of medications for your individual condition. Development of PTDM has not been the end point of prospective trials; therefore recommendations for immunosuppressive therapy must be based on observational studies of the incidence of PTDM in groups of patients treated with different protocols. Talk to your doctor about your immunosuppression.

Q: What can I do to delay or prevent PTDM?

Access to dietitians, diabetic educators and endocrinologists is crucial for people with PTDM, or for those at risk for developing it. They can talk with you about how to adjust your lifestyle to improve your health. Some goals that reduce your risk of developing PTDM or decreasing its health risks include:

- ❖ Preventing weight gain or losing weight
- ❖ Controlling carbohydrate intake
- ❖ Controlling intake of lipid (fats)
- ❖ Controlling blood pressure to preserve kidney function and reduce cardiovascular risk. New K/DOQI* guidelines for blood pressure control in transplant recipients indicate no specific drug preferences.
- ❖ Daily administration of aspirin (81–325 mg) to reduce risk of vascular events.
- ❖ Early insulin administration may help preserve residual islet function.



* Kidney Disease Outcomes Quality Initiative—The clinical practice guidelines for treating kidney disease, developed by the National Kidney Foundation.

Q: What about self-monitoring my blood sugar?

You will need to monitor your blood sugar regularly. In addition to office visits to your doctor, you may use a self-monitoring blood glucose kit. The kit includes a meter with a readout that allows you to see your blood glucose level in a matter of seconds, after drawing a drop of blood from your arm, thigh or hand with a spring-loaded device and special needle. The goal of home blood sugar monitoring is to keep fasting blood sugars less than 120 mg/dl. Blood sugar levels measured after eating should not be over 140-160 mg/dl. Hemoglobin A1C levels should be measured quarterly, with a target of seven percent or less. These recommendations are not widely followed in the transplant setting, and you may need to bring this to your physician's attention. Take advantage of the services of dietitians, diabetic educators and diabetes specialists. You may also ask to be considered for a pancreas transplant.

Q: Does the risk for PTDM increase over time?

You are most at risk the first three to six months after transplant, but you remain at risk throughout the life of your transplanted organ. PTDM poses the same risks to transplant outcome over 8 to 10 years as diabetes that predated the transplant operation, mostly because of the risk to the cardiovascular system. Careful monitoring of glucose tolerance should be an accepted part of aftercare. One year after transplant, fasting plasma glucose should be measured with every determination of kidney function, usually every three to four months.

Q: Is diabetes a serious threat to my health?

Yes. PTDM after a successful kidney transplant is common and poses danger to the survival of the organ and the patient. Diabetes after transplant can lead to serious complications. Because diabetes is a leading cause of kidney failure, this condition may lead to the need for an additional kidney transplant. Diabetes can also damage the nervous system, eyes, kidneys and blood vessels. Diabetes is one of the underlying causes of heart disease, high blood pressure, stroke, blindness, kidney disease, amputation and other serious conditions.

Q: Is there a cure?

Though there is no cure, diabetes can be treated. Nutrition is paramount because the food you eat has a direct effect on your blood glucose levels. Your doctor will prescribe a diet for you. Exercise goes hand in hand with diet. You may also be advised to lose weight and reduce stress. Good dental care, foot care, eye and skin care will help in avoiding complications later on.

Summary of PTDM Health Issues

Blood Pressure

- Benefits of blood pressure control
 - Preserves GFR
 - Improves donor organ survival
 - Reduces risk of cardiovascular death
- Target BP levels
 - ADA* K/DOQI[†] <130-135/80

Blood Sugar Control

- Benefits of glycemic control
 - Important for prevention of microvascular and macrovascular disease
 - Reduces lipid glycosylation and oxidation
 - Reduced endothelial and protein glycosylation
 - Reduces infections
 - Improved wound healing
 - Improves triglycerides
 - Reduces diabetes complications
- Home glucose monitoring with targets:
 - FBS** < 120
 - PPG^{††} < 140-160

* American Diabetes Association

† Kidney Disease Outcomes Quality Initiative

** Fasting Blood Sugar

†† Post Prandial Glucose

Weight Control

- Obesity increases the risk of PTDM
 - Increased risk of PTDM with BMI* ≥ 25
- Diabetes Prevention Program suggests benefits of weight loss (10% of body weight)
 - Improves insulin resistance and diabetes
 - Improves cardiovascular risk
- Goal of recipient is to avoid excessive weight gain after transplantation

Peripheral Vascular Disease

- Significant source of morbidity and mortality
- Prevention
 - Monitoring lipids and treating abnormalities
 - Quitting smoking
 - Regular examination of feet

Immunosuppressive Medications

- Even a small reduction in corticosteroid dosing can reduce the risk of PTDM
- Calcineurin inhibitors increase the risk of diabetes
- Targeting lower blood levels in tacrolimus and cyclosporine can reduce the risk of PTDM and improve hyperglycemia. Evidence suggests substituting cyclosporine for tacrolimus may reduce the risk of PTDM.
- Mycophenolate mofetil, especially in combination with tacrolimus, could negatively impact patients with diabetic enteropathy.

* Body Mass Index



Eating Healthy With Diabetes

No single food will supply all the nutrients your body needs, so good nutrition means eating a variety of foods.

Food is divided into four main groups. They are:

- ❖ Fruits and vegetables (e.g., oranges, apples, bananas, carrots and spinach).
- ❖ Whole grains, cereals, and bread (e.g., wheat, rice, oats, bran and barley).
- ❖ Dairy products (e.g., whole or skim milk, cream and yogurt).
- ❖ Protein (e.g., meats, fish, poultry, eggs, dried beans and nuts).

It is important to eat foods from each group every day. By doing that, you ensure your body has all the nutrients it needs. Nutrients help your body function correctly.

The main nutrients in food are *carbohydrates, proteins, fats, vitamins and minerals*. Carbohydrates give you energy. Healthy choices are dried beans, peas and lentils; whole grain breads, cereals and crackers; and fruits and starchy vegetables. Protein is needed for growth and is a good back-up supply of energy. Healthy choices include lean meats and low-fat dairy products.

Foods high in fiber are healthy, too. Fiber comes from plants and may help to lower blood glucose and blood-fat levels. Foods high in fiber include bran cereals, cooked beans and peas, whole-grain bread, fruits and vegetables.

Which foods are unhealthy?

Fat is a nutrient, and you need some fat in your diet. But too much fat is not good for anyone, and it can be very harmful to people with diabetes. Too much fat or cholesterol may increase the chances of heart disease and/or hardening of the arteries. People with diabetes have a greater risk of developing these diseases than those without diabetes. It is very important that you limit the fat in your diet.

Fat is found in many foods. Red meat, dairy products (whole milk, cream, cheese and ice cream), egg yolks, butter, salad dressings, vegetable oils and many desserts are high in fat. To cut down on fat and cholesterol, you should:

- ❖ Choose lean cuts of meat. Remove extra fat.
- ❖ Eat more fish and poultry (without the skin).
- ❖ Use diet margarine instead of butter.
- ❖ Drink low fat or skim milk.
- ❖ Limit the number of eggs you eat to three or four a week and choose liver only now and then.



Too much salt may worsen high blood pressure. Many foods contain salt. Sometimes, you can taste it (as in pickles or bacon). But there is also hidden salt in many foods, such as cheeses, salad dressings and canned soups.

People with diabetes should eat less sugar. Foods high in sugar include desserts such as frosted cake and pie, sugary breakfast foods, table sugar, honey and syrup. One 12-ounce can of a regular soft drink has nine teaspoons of sugar. Monitor your sugar intake.

Sweeteners

More than a dozen studies have shown that sugars in foods don't spike blood glucose any higher or faster than starches. The American Diabetes Association nutritional recommendations say, "Scientific evidence has shown that the use of sucrose as part of the meal plan does not impair blood glucose control in individuals with type 1 or type 2 diabetes."

However, one important rule remains: You need to work sugar into the meal plan that you have set up with your dietitian. Sugar is not a “free food.” It counts as a carbohydrate. When you choose to eat foods that contain sugar, you need to substitute them for carbohydrate foods in your meal plan.

Planning Meals

Eating healthy is especially important for people with diabetes because the type and amounts of food can have a great impact on your blood sugar. By carefully choosing what and when you eat, you can help maintain healthy blood sugar levels and reduce your risk of long-term complications from diabetes.

You and your dietitian should work together to design a meal plan that's right for you and includes foods that you enjoy. A diabetes meal plan is a guide that tells you how much and what kinds of food you can choose to eat at meals and snack times. A good meal plan should fit in with your schedule and eating habits. The right meal plan will also help you maintain a healthy weight.

There are several methods of meal planning. Two include using the Food Pyramid and Exchange lists. Utilizing food labels can also help you to choose healthy foods when shopping. A meal plan form is available, courtesy of the American Diabetes Association (see resource page), to help you initiate discussions with your diabetes educator, registered dietitian or nutritionist.

Every person with diabetes should have a personal meal plan based on his or her needs and lifestyle. A Registered Dietitian (RD) can help you develop your meal plan. Find a registered dietitian near you:

1. To locate the names of American Diabetes Association Recognized Diabetes Education Programs in your area or call 1-800-DIABETES (1-800-342-2383).
2. Call the American Association of Diabetes Educators, at 1-800-TEAM-UP4 (1-800-832-6874). The operator will give you the names of several diabetes educators in your zip code.

Eating Out Guide

Eating out can be fun and healthy if you plan ahead and choose wisely to find foods that fit into your meal plan. Many restaurants are trying to meet diners' health needs. Even people without diabetes have been looking for healthier options at restaurants, so more healthy food is becoming available.

Not everyone with diabetes has the same meal plan or the same nutrition goals. Work with your health care team to identify your own goals. If you eat out a lot, find ways to follow your meal plan as much as possible. Pick a restaurant with a variety of choices to increase your chances of finding the foods that suit your meal plan.

How to order. . .

- ❖ If you take diabetes pills or insulin shots, think about when you'll eat as well as what you'll eat. Ask others to eat at your usual time.
- ❖ If you don't know what's in a dish or don't know the serving size, ask.
- ❖ Try to eat the same portion as you would at home. Put the extra food in a container to go.
- ❖ Eat slowly.
- ❖ Ask for fish or meat broiled with no extra butter.
- ❖ Order your baked potato plain, then top it with a teaspoon of margarine or low-calorie sour cream, and/or vegetables.
- ❖ Ask for sauces, gravy and salad dressings "on the side."
- ❖ Order foods that are not breaded or fried because they add fat. If the food comes breaded, peel off the outer coating.
- ❖ Read the menu creatively. Order a fruit cup for an appetizer or the breakfast melon for dessert. Instead of a dinner entree, combine a salad with a low-fat appetizer.
- ❖ Ask for substitutions. Instead of french fries, request a double order of a vegetable. If you can't get a substitute, just ask that the high-fat food be left off your plate.

- ❖ Ask for low-calorie items, such as salad dressings, even if they're not on the menu. Vinegar and a dash of oil or a squeeze of lemon are a better choice than high-fat dressings.
- ❖ Limit alcoholic beverages, because they add calories but no nutrition to your meal.

✍ **Plan ahead, choose wisely, and you'll find foods that fit into your meal plan.**

Thank you to the American Diabetes Association for providing information for this section.



Exercise

Beginning an exercise program can be mentally and physically challenging, especially if you've been diagnosed with diabetes. But it's never too late. With determination and perseverance, you can always improve your level of fitness. Even if you have never exercised before, or if you haven't exercised in a long time, it is possible for you to make an exercise program part of your life!

Of course, you can't exercise when you are ill or when your blood sugar levels are out of control. But once you are feeling better, regular physical activity will help you stay well. If you stick with it, you may even find you don't get sick as much and may need less medication.

Believe it or not, regular physical activity will give you more energy. Toning your muscles and conditioning your heart, lungs and blood vessels will better equip you to handle the work and stress of daily life.

The First Step

The first step to fitness is to visit your doctor. Before you begin any exercise program, get a thorough medical exam. The exam should check:

- ❖ Blood pressure
- ❖ Lipids (blood fat levels)
- ❖ Glycohemoglobin and current blood glucose level
- ❖ Health of heart and circulatory system
- ❖ Body composition (fat versus lean)
- ❖ Eyes and feet.

Your doctor should help determine your level of fitness. Talk to your doctor about what types of exercise or exercise programs are good choices for you. Some complications of diabetes make certain types of physical activity bad choices. The benefits of an exercise program need to outweigh the risks.

If possible, get an exercise prescription. This is an exercise plan that takes into account your current level of fitness, special health concerns and your diabetes treatment plan. Your health care providers are your best resources.

Safety Tip

Exercise can improve your health and your outlook on life. If you have diabetes, it pays to be extra careful not to injure yourself or upset your diabetes control.

Thank you to the American Diabetes Association for providing information for this section.

A Recipient Speaks Out

From Resistance to Resentment to Routine: Living with Post Transplant Diabetes

By Rev. Janna T. Steed, kidney recipient (Originally published in Transplant Chronicles, Vol 10, No. 1 Summer 2002. Reprinted with permission from the National Kidney Foundation.)

While on a waiting list for a liver transplant, checking my blood sugar levels and eating on a regular schedule became a part of my life. But I never anticipated I would still be doing those things if I were fortunate enough to receive an organ and survive the surgery.

Last June, I had a living-donor transplant at the University of Nebraska Medical Center and since then I've been on insulin. When one of the nurse coordinators asked me to write about coping successfully with post transplant diabetes, I responded, "Have I done that?" I told her I was still hoping that as my medication is further reduced I would eventually not require insulin. Writing this article, however, has challenged me simply to accept that, like many organ-transplant recipients, I became a diabetic as part of the price for life-saving surgery. This exercise seems like another step in my transplant recovery.

When I began receiving insulin in the hospital, I assumed this was a temporary measure. Both the immunosuppressive drugs and the feeding-tube formula raised my blood sugar levels. Once I was weaned off the one and on reduced doses of the other, the high readings would surely drop. And they did, as did the doses of insulin. Giving myself injections was something I'd done before for other conditions. The hospital's approach was not to restrict diet at first. I ate whatever and whenever I wanted. No big deal, I thought.

But treatment for diabetes continued after I went home. I had unpredictable highs and lows that seemed to require frequent phone calls and continual adjustment of insulin type and dosage.

About six months after my living donor liver transplant, I was complaining to a psychotherapist about how burdensome my health care seemed. Although I certainly felt better, I was spending more time on self-care than when I had an untreatable terminal illness!

Of course, I was grateful to be alive. Yet keeping track of my medications, checking blood pressure and blood sugars, taking injections, getting regular exercise, preparing appropriate foods, etc., seemed like a full-time job.

My counselor asked, "Could you make all these necessary things just part of your routine?" The answer was obvious: Of course. We do this when we learn to wash our hands before meals and brush our teeth after them, when we learn that eating green apples makes your stomach hurt and drinking coffee keeps you awake. We acquire these little habits that protect our health, and then think little about them. And we allow ourselves time for essential daily tasks. Thirty years earlier I had learned to make ileostomy care part of my routine. I had dealt with medications, testing and dietary restrictions most of my life. All the coping skills I had learned would apply here, too. And I could give up the notion that my having suffered with other diseases should serve as inoculation against this one. No earned exemptions come with this surgery.

When I thought the diabetes was temporary, I could just concentrate on the mechanics of management, without anxiously anticipating future problems. Later, I had to make those mechanics a part of my daily routine and any travel plans so that they didn't seem so burdensome. And it isn't that hard to find ways to indulge my love for good food, even with restrictions on carbohydrate intake. Now the challenge is to see my consistent self care as essential to protecting myself from the long-term risks of diabetes. Diabetes is a reality, but it doesn't have to cheat me of living life fully.

Rev. Janna Tull Steed is a writer, jazz singer, United Methodist minister and an authority on the music of Duke Ellington, composer and bandleader. Her book, Duke Ellington, A Spiritual Biography, was published in 1999, while Janna was waiting for a liver transplant to treat primary sclerosing cholangitis (PSC). In June 2001, Janna and her friend Jean Anne Paul underwent the first nonrelated living-donor liver transplant performed at the University of Nebraska Hospital in Omaha. Both are doing well.

Glossary of Terms Related to Diabetes

Blood glucose meter – A small portable machine used to measure the level of glucose in a person's blood at the time of testing. Can be used at home.

Blood Pressure – The force of the blood pushing against the walls of the arteries. This pressure moves blood from the heart to organs.

Body Mass Index (BMI) – The BMI is one of the most accurate ways to determine whether or not an adult is overweight. BMI uses a person's weight and height to estimate total body fat.

Diabetes Mellitus – A disease (also called simply “diabetes”) that occurs when the body does not make enough insulin or when the body cannot use normal amounts of insulin properly.

Type 1 – (not discussed in this brochure) Called insulin-dependent diabetes mellitus or juvenile diabetes. Usually begins in childhood, but the disorder can appear at any age. The pancreas does not make enough insulin resulting in the need for insulin injections. Symptoms include increased thirst and urination, constant hunger, weight loss, blurred vision, and extreme tiredness.

Type 2 – (most common type) Non-insulin-dependent diabetes mellitus. The pancreas makes insulin, but the body does not use it properly. The end result is the same as for type 1 diabetes—an unhealthy buildup of glucose in the blood and an inability of the body to make efficient use of its main source of fuel. Symptoms include feeling tired or ill, frequent urination (especially at night), unusual thirst, weight loss, blurred vision, frequent infections, and slow healing of sores.

Diabetic Ketoacidosis (diabetic coma) – Diabetic ketoacidosis is a complication of diabetes caused by the buildup of ketones that occurs when glucose is not available as a fuel source for the body.

Diabetic nephropathy – Kidney damage caused by a persistently high blood sugar level from diabetes. High blood sugar damages the filtering system of the kidneys allowing protein that would normally stay in the blood to pass into the urine.

Diabetic neuropathy – A common complication of long-term diabetes. It results from damage to the nerves that connect the spinal cord and brain to the rest of the body.

Edema – Extra fluid in the body tissues, resulting in swelling and puffiness.

Gestational diabetes – A type of diabetes that develops in some women during pregnancy because their body is not able to produce enough insulin to keep blood sugar within a range that is safe for the woman and her fetus.

Glomerular filtration rate (GFR) – Glomerular filtration rate is the efficacy with which the kidneys filter the blood, removing excess wastes and fluids. GFR is used to determine how well the blood is filtered by the kidneys. It is one way to measure remaining kidney function.

Glaucoma – A group of eye diseases in which a specific pattern of damage to the nerve located in the back of the eye results in loss of eyesight. People with diabetes tend to have higher pressure in their eyes than those without the disease. This may put people with diabetes at increased risk for developing glaucoma.

Glucagon – A hormone produced by the pancreas that causes the liver to release its stored sugar into the bloodstream.

Glucose – A type of sugar found in fruits and many other foods. It is the main source of energy used by the body.

Glycemic control – Maintaining good control of blood sugar levels.

Hyperglycemia (high blood glucose) – Abnormal elevation in blood glucose levels. Hyperglycemia frequently or for long periods of time will result in damage to nerves, blood vessels, and other body organs.

Hypoglycemia (low blood glucose) – A condition that occurs when blood levels of glucose drop too low to properly fuel the body.

Hypertension (high blood pressure) – A condition that occurs when the force of the blood against artery walls increases enough to cause damage. Hypertension is called a “silent killer” because it does not cause symptoms unless it is severely high.

Insulin – A hormone produced in the pancreas that regulates the amount of sugar in the blood.

K/DOQI – (Kidney Disease Outcomes Quality Initiative) Clinical Practice guidelines for the treatment of kidney disease developed by the National Kidney Foundation. Medical information designed to support, not replace, the relationship that exists between a patient or site visitor and his/her physician.

Macular edema – Diabetic macular edema is common in diabetics. The condition is closely associated with the degree of diabetic retinopathy (retinal disease). Swelling in the retina due to a leak of fluid from blood vessels within the macula. The macula is a central portion of the retina that detect color and is essential to daytime vision.

Metabolism – Physical and chemical process within the body related to body functions, such as energy generation and use, digestion, absorption, elimination, respiration, circulation and temperature regulation.

Obesity – Obesity is a long-term (chronic), complex disease in which having too much body fat increases your risk for developing other health problems. Obesity generally is measured by body mass index. A BMI of 30 or more is considered obese in adults.

Pancreas – An organ that produces digestive juices that help break down (digest) food, and hormones (such as insulin) that regulate how the body stores and uses food.

Peripheral neuropathy – It is the most common type of neuropathy. It reduces your ability to sense pain, touch, temperature and vibration in certain parts of the body and may sometimes affect movement and muscle strength. It most often affects the feet and lower legs and may contribute to serious foot problems. Patients with diabetes should have their feet examined at least once a year.

Resources

American Diabetes Association: www.diabetes.org

American Dietetic Association: www.eatright.org

American Association of Diabetes Educators (information for the general public): www.aadenet.org

CDC Diabetes Public Health Resources (Centers for Disease Control and Prevention): www.cdc.gov/diabetes

Joslin Diabetes Center (affiliate of Harvard Medical school):
www.joslin.harvard.edu/main.shtml

National Institute of Diabetes and Digestive and Kidney Diseases of the National Institutes of Health: www.niddk.nih.gov

View information on modifiable risk factors

Body weight: www.nhlbi.nih.gov/subsites/index.htm

Blood pressure: www.nhlbi.nih.gov/hbp

Cholesterol: www.nhlbi.nih.gov/chd

Diet: www.nutrition.gov

Smoking: www.cdc.gov/tobacco/sgr/sgr_2000

NKF Resources on Transplantation

Kidney Transplant

Nutrition and Transplantation

Keeping Your Bones Healthy When You Have a Kidney Transplant
(also in Spanish)

Keeping Your Heart Healthy When You Have a Kidney Transplant
(also in Spanish)


transAction Council Membership Brochure

www.kidney.org

NOTES

NOTES

More than 20 million Americans—one in nine adults—have chronic kidney disease, and most don't even know it. More than 20 million others are at increased risk for kidney disease. The National Kidney Foundation, a major voluntary health organization, seeks to prevent kidney and urinary tract diseases, improve the health and well-being of individuals and families affected by these diseases, and increase the availability of all organs for transplantation. Through its 50 affiliates nationwide, the foundation conducts programs in research, professional education, patient and community services, public education and organ donation. The work of the National Kidney Foundation is funded by public donations.

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