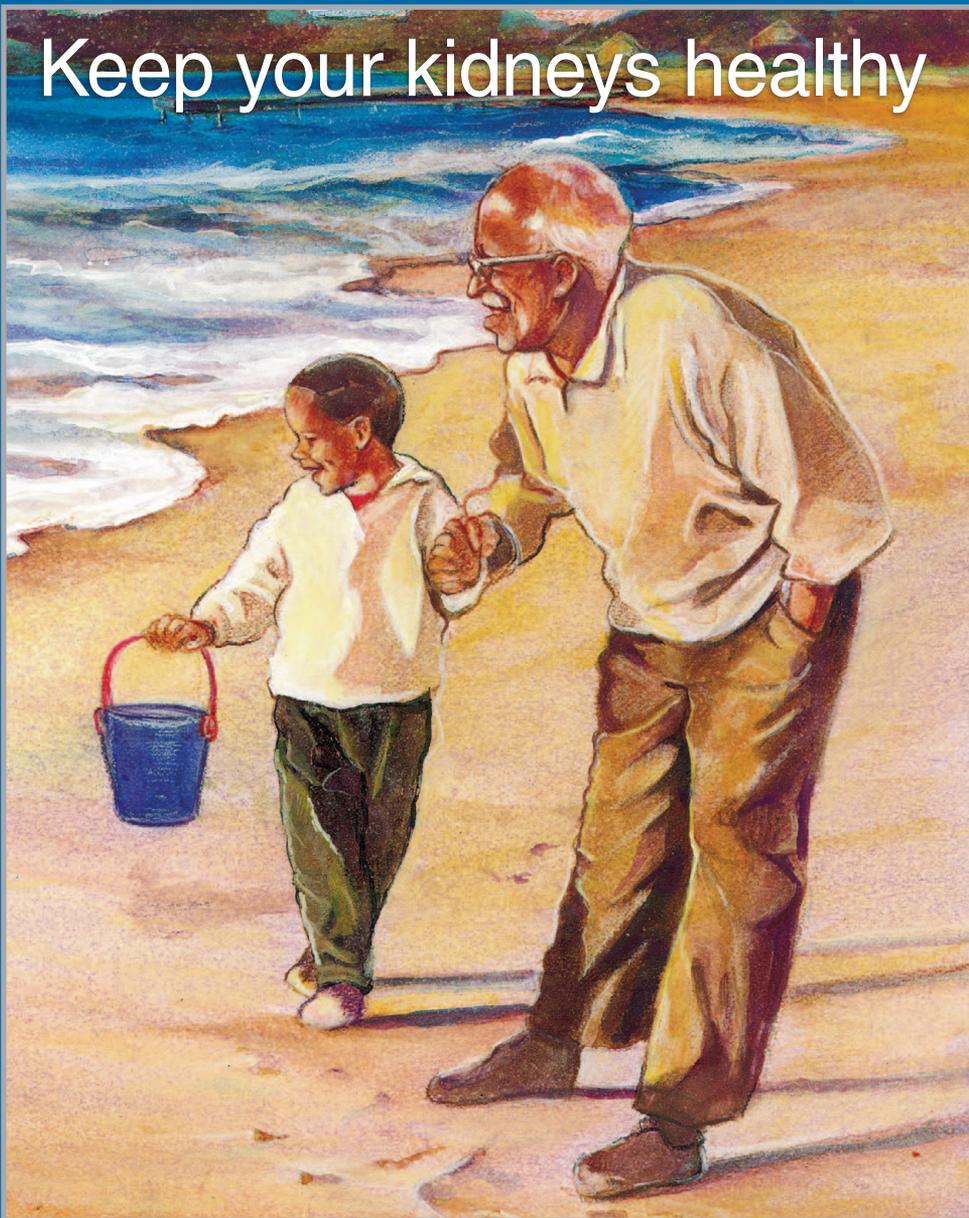


Prevent diabetes problems

Keep your kidneys healthy



National Institute of
Diabetes and Digestive
and Kidney Diseases

National Diabetes Information
Clearinghouse

Prevent diabetes problems:
Keep your kidneys healthy

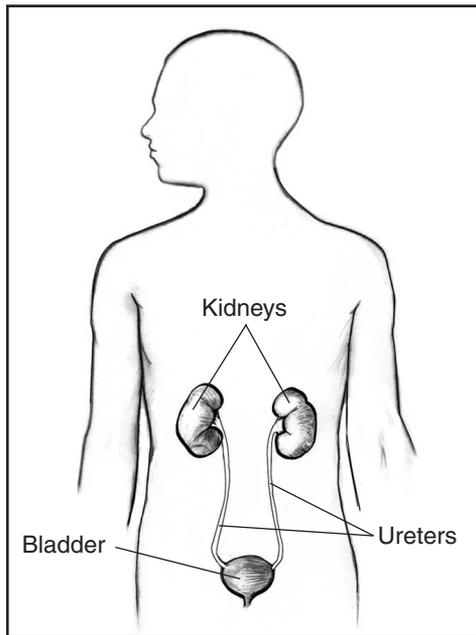
Contents

What are my kidneys and what do they do?	1
How can diabetes affect my kidneys?	2
What are blood pressure and high blood pressure?	3
How does high blood pressure affect my kidneys if I have diabetes?	4
What should my blood pressure be?	4
What are the symptoms of diabetic kidney disease?	6
How can I find out if I have diabetic kidney disease?	8
What can I do if I have diabetic kidney disease?	10
Eating, Diet, and Nutrition	11
How can x rays affect my kidneys?	14
What is kidney failure?	14
What happens if my kidneys fail?	15
How does smoking affect my diabetes and kidneys?	19

How can I keep my kidneys healthy? 20
Pronunciation Guide..... 23
For More Information 24
More in the Series..... 28
Acknowledgments 29

What are my kidneys and what do they do?

Your kidneys are two bean-shaped organs, each about the size of a fist. They are located just below your rib cage, one on each side of your spine. Every day, your two kidneys filter about 120 to 150 quarts of blood to produce about 1 to 2 quarts of urine. Urine flows from your kidneys to your bladder through tubes called ureters. Your bladder stores urine until releasing it through urination.



How can diabetes affect my kidneys?

Too much **glucose**,* also called sugar, in your blood from diabetes damages your kidneys' filters. If the filters are damaged, a protein called **albumin**, which you need to stay healthy, leaks out of your blood and into your urine. Damaged kidneys do not do a good job of filtering wastes and extra fluid from your blood. The wastes and extra fluid build up in your blood and make you sick.

Diabetes is a leading cause of kidney disease. Diabetic kidney disease is the medical term for kidney disease caused by diabetes. Diabetic kidney disease affects both kidneys at the same time.

If kidney disease runs in your family, you are also at risk for kidney disease. Talk with your family members about their medical history and your doctor about having your kidney function tested.

*See the Pronunciation Guide for tips on how to say the words in **bold** type.

What are blood pressure and high blood pressure?

Blood pressure is the force of blood flow inside your blood vessels. Blood pressure is written with two numbers separated by a slash. For example, a blood pressure result of 130/80 is said as “130 over 80.” The first number is the pressure in your blood vessels as your heart beats and pushes blood through your blood vessels. The second number is the pressure as your blood vessels relax between heartbeats.

High blood pressure forces your heart to work harder to pump blood. High blood pressure can strain your heart, damage your blood vessels, and increase your risk of heart attack, stroke, eye problems, and kidney problems.

How does high blood pressure affect my kidneys if I have diabetes?

High blood pressure is the other leading cause of kidney disease in people with diabetes. High blood pressure also is a result of damage from kidney disease. If you have high blood pressure, your kidneys may already be damaged. Even a small rise in blood pressure can quickly make kidney disease worse.

What should my blood pressure be?

Your blood pressure goal should either be below 140/80 or 140/90 depending on whether you have kidney disease and how severe it is. Discuss your personal goal with your doctor.



Many people with diabetes have high blood pressure. However, keeping your blood pressure at your goal will help prevent damage to your kidneys, heart, brain, blood vessels, and other parts of your body. Meal planning, medicines, and physical activity can help you reach your blood pressure goal.

Have your blood pressure checked at every health care visit. Ask your doctor if you need medicine to control your blood pressure. Medicine that helps control your blood pressure can slow progression of kidney disease.

Two types of blood pressure-lowering medicines, **angiotensin**-converting enzyme (ACE) **inhibitors** and angiotensin receptor blockers (ARBs), have been found to slow progression of kidney disease in people with diabetes.



What are the symptoms of diabetic kidney disease?

In the early stages, diabetic kidney disease does not have any symptoms. Kidney disease happens so slowly that you may not feel sick at all for many years. You may not feel sick even when your kidneys do only half the job of healthy kidneys. Only your doctor can tell if you have kidney disease by checking the protein, or albumin, level in your urine at least once a year.

The first symptom of diabetic kidney disease is often swelling in parts of your body, such as your hands, face, feet, or ankles. Also, large amounts of protein in your urine may cause urine to look foamy. Once your kidney function starts to decrease, other symptoms may include

- increased or decreased urination
- feeling drowsy or tired
- feeling itchy or numb
- dry skin
- headaches
- weight loss

- not feeling hungry
- feeling sick to your stomach
- vomiting
- sleep problems
- trouble staying focused
- darkened skin
- muscle cramps



Kidney disease may
cause you to feel sick
to your stomach.

How can I find out if I have diabetic kidney disease?

The following tests can tell you and your doctor if you have diabetic kidney disease:

- **Blood pressure test.** Your doctor will use a blood pressure cuff to check your blood pressure. You should have this test done at every health care visit.
- **Albumin and creatinine measurement.** Your doctor will ask you for a sample of your urine to look for albumin. A high level of albumin in your urine may mean you have kidney disease. The urine sample is sent to a lab for a test that looks at the amount of albumin compared with the amount of creatinine, a waste product also in your urine. A urine albumin-to-creatinine ratio test result above 30 is a warning sign of kidney disease. You should have this test at least once a year.

- **Estimated glomerular filtration rate (eGFR) test.** Blood drawn at your doctor's office and sent to a lab can be tested to measure how much blood your kidneys filter each minute. If your kidneys are not filtering enough blood, you may have kidney damage or kidney failure. You should have this test at least once a year. The test results show the following:
 - eGFR of 60 or above is in the normal range
 - eGFR below 60 may mean you have kidney disease
 - eGFR of 15 or below may mean you have kidney failure

If your blood and urine test results show evidence of kidney damage or disease, your doctor may suggest more tests to help find out whether you have other health problems causing the damage. Other tests can include blood and urine samples for additional lab tests and imaging tests, or pictures, of your kidneys. Your doctor also may need to perform a biopsy, in which a small piece of tissue is removed from your kidney to look at with a microscope.

What can I do if I have diabetic kidney disease?

Once you have diabetic kidney disease, you can slow it down or stop it from getting worse by watching your blood glucose and blood pressure numbers closely to keep them under control.

If you have high blood pressure or protein in your urine, you can take an ACE inhibitor or ARB to control your blood pressure and reduce kidney damage. If you are pregnant, you should not take an ACE inhibitor or ARB.

See your doctor often. Have your urine and blood tested as your doctor advises to see how well your kidneys are working. You also may need to see a **nephrologist**—a doctor who specializes in kidney disease.



Eating, Diet, and Nutrition

Your dietitian or doctor may suggest a special eating plan for you. You may have to avoid a diet high in protein, fat, **sodium**, and **potassium**.

- Cut back on protein, especially animal products such as meat. Damaged kidneys may fail to remove protein waste products from your blood. Diets high in protein make your kidneys work harder and fail sooner.
- Avoid a high-fat diet. High-fat diets are high in **cholesterol**. Cholesterol is a type of fat found in your body's cells, blood, and many foods. Your body needs some cholesterol to work the right way. For example, your body uses cholesterol to make certain essential hormones and maintain nerve function. However, your body makes all the cholesterol it needs. If you often eat foods that are high in cholesterol, or if high cholesterol runs in your family, extra cholesterol in your blood can build up over time in the walls of your blood vessels and arteries. High blood cholesterol can lead to heart disease and stroke, some of the biggest health problems for people with diabetes.

- Avoid high-sodium foods. Sodium is a mineral found in salt and other foods. High levels of sodium may raise your blood pressure. Some high-sodium foods include canned food, frozen dinners, and hot dogs. The amount of sodium is listed on the food label, so you can see which foods have the highest levels. Try to limit your sodium to less than a teaspoon a day, or about 2,300 milligrams (mg) a day. If you have high blood pressure or are African American, middle-aged, or older, aim for no more than 1,500 mg of sodium per day. Ask your doctor or your dietitian about how much sodium you can have.
- Ask your doctor about the amount of potassium you need. Potassium is a mineral that helps your heartbeat stay regular and muscles work right. Healthy kidneys keep the right amount of potassium in your body. However, if you have severe kidney damage, high levels of potassium may cause an abnormal heart rhythm or even make your heart stop, called cardiac arrest. Some high-potassium foods include apricots, bananas, oranges, and potatoes.

Read more about healthy eating and kidney disease in these publications at www.kidney.niddk.nih.gov:

- *Eat Right to Feel Right on Hemodialysis*
- *Nutrition for Advanced Chronic Kidney Disease in Adults*
- *Nutrition for Early Chronic Kidney Disease in Adults*
- *What I need to know about Eating and Diabetes*

How can x rays affect my kidneys?

X rays that use a special dye—known as contrast medium—to give a better picture of your organs can pose a risk to your kidneys. Contrast medium that is injected into your blood vessels is the type that can cause kidney damage. If you need x rays with contrast medium injected into your blood vessels, your doctor can give you extra fluids and medicine before and after the x rays to protect your kidneys. Or, your doctor may decide to order a test that does not use contrast medium.

What is kidney failure?

Kidney failure, also called end-stage kidney disease or ESRD, means your kidneys no longer work well enough to do their job. You will need treatment to replace the work your kidneys have stopped doing.

What happens if my kidneys fail?

The two treatments for kidney failure are **dialysis** and a kidney transplant.

Dialysis

One way to treat kidney failure is with dialysis, which does some of the work your kidneys used to do.

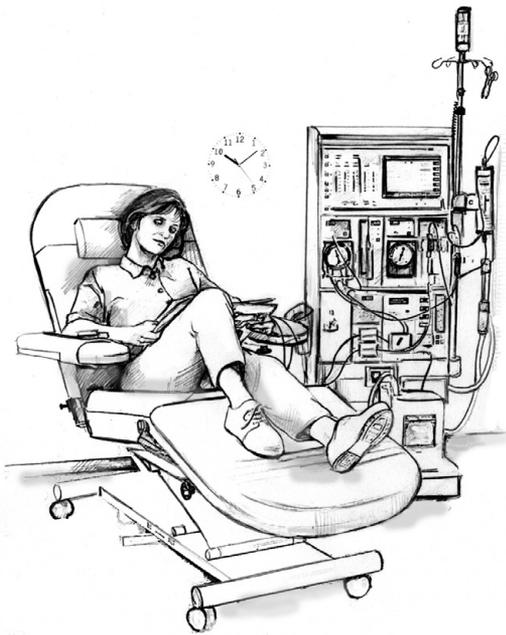
One form of dialysis, called **hemodialysis**, uses a machine to circulate your blood through a filter outside your body. If you choose hemodialysis, you should watch how much liquid you drink.

Your dietitian will help you figure out how much liquid to drink each day. Extra liquid can raise your blood pressure, make your heart work harder, and increase the stress of dialysis treatments.

Remember that many foods—such as soup, ice cream, and fruits—contain water. Ask your dietitian for tips on controlling your thirst.

The other form of dialysis, called **peritoneal** dialysis, uses the lining of your abdomen, or the area between your chest and hips, to filter your blood inside your body.

You and your doctor will decide which type of dialysis will work best for you.



Dialysis does some of the work your kidneys used to do.

Read more in these publications at
www.kidney.niddk.nih.gov:

- *Treatment Methods for Kidney Failure: Hemodialysis*
- *Treatment Methods for Kidney Failure: Peritoneal Dialysis*
- *Kidney Failure: Choosing a Treatment That's Right for You*

Kidney Transplant

Another way to treat kidney failure is to have a kidney transplant. This operation gives you a healthy kidney from a donor.

A donor may be a living person. A living donor may be a blood relative, such as a parent, brother, sister, or child, or a close friend or nonblood relative, such as a spouse. A living kidney donation offers the best-quality kidney with the shortest wait time. Donating a kidney does not put the donor at risk for future health problems.

If you cannot get a kidney from a living donor, your name can be placed on the national waiting list for a deceased donor kidney, or a kidney that is taken from a person who has just died or suffered brain death. The wait for a deceased donor kidney is often longer than the wait for a living donor kidney.

Both living and deceased donor kidneys should be a good match for your body.

How does smoking affect my diabetes and kidneys?

If you already have kidney disease, smoking can worsen any blood vessel, heart, and kidney problems. Kidney cancer is also more common in smokers.

Smoking and diabetes are a dangerous mix. Smoking raises your risk for many diabetes problems. If you quit smoking,

- you will lower your risk for heart attack, stroke, nerve disease, kidney disease, and **amputation**, which is surgery to cut off a body part
- your cholesterol and blood pressure levels might improve
- your blood **circulation** will improve

If you smoke, stop smoking. Ask for help so that you don't have to do it alone. You can start by calling 1-800-QUITNOW or 1-800-784-8669.



How can I keep my kidneys healthy?

You can keep your kidneys healthy by taking these steps:

- Keep your blood glucose numbers as close to your target as possible. Your doctor will work with you to set your target blood glucose numbers and teach you what to do if your numbers are too high or too low.
- Keep your blood pressure numbers as close to your personal goal as possible. If you take blood pressure medicine, take it as your doctor advises.
- Eat healthy meals and follow the meal plan that you and your doctor or dietitian have worked out. If you already have kidney disease, you may have to avoid a diet high in protein, fat, sodium, and potassium.
- If you choose hemodialysis, watch how much liquid you drink. Your dietitian will help you figure out how much liquid to drink each day.

- At least once a year, have these tests for kidney disease:
 - blood pressure test
 - albumin and creatinine measurement
 - eGFR
- Have any other kidney tests your doctor thinks you need.
- Avoid taking painkillers often. Daily use of nonsteroidal anti-inflammatory drugs, such as the arthritis-type painkillers ibuprofen and naproxen, can damage your kidneys. If you are dealing with chronic, or long lasting, pain from a health problem such as arthritis, work with your doctor to find a way to control your pain without putting your kidneys at risk.

- See a doctor right away for bladder or kidney infections. You may have an infection if you have these symptoms:
 - pain or burning when you urinate
 - a frequent urge to urinate
 - urine that looks cloudy, reddish, or dark
 - fever or a shaky feeling
 - pain in your back or on your side below your ribs
- If you smoke, stop smoking.



Pronunciation Guide

albumin (al-BYOO-min)

amputation (AM-pyoo-TAY-shuhn)

angiotensin (AN-jee-oh-TEN-sin)

cholesterol (koh-LESS-tur-ol)

circulation (SUR-kyoo-LAY-shuhn)

creatinine (kree-AT-ih-neen)

dialysis (dy-AL-ih-siss)

glucose (GLOO-kohss)

hemodialysis (HEE-moh-dy-AL-ih-siss)

inhibitors (in-HIB-ih-turs)

nephrologist (neh-FROL-uh-jist)

peritoneal (PAIR-ih-toh-NEE-uhl)

potassium (poh-TASS-ee-uhm)

sodium (SOH-dee-uhm)

For More Information

To find diabetes educators (nurses, dietitians, pharmacists, and other health care providers), contact

American Association of Diabetes Educators

200 West Madison Street, Suite 800

Chicago, IL 60606

Phone: 1-800-338-3633

Internet: www.diabeteseducator.org

To find dietitians, contact

Academy of Nutrition and Dietetics

120 South Riverside Plaza, Suite 2000

Chicago, IL 60606-6995

Internet: www.eatright.org

Click on “Find a Registered Dietitian.”

To learn more about kidney problems from diabetes, contact

**National Kidney and Urologic Diseases
Information Clearinghouse**

3 Information Way

Bethesda, MD 20892-3580

Phone: 1-800-891-5390

TTY: 1-866-569-1162

Fax: 703-738-4929

Email: nkudic@info.niddk.nih.gov

Internet: www.kidney.niddk.nih.gov

National Kidney Disease Education Program

3 Kidney Information Way

Bethesda, MD 20892

Phone: 1-866-4-KIDNEY (1-866-454-3639)

TTY: 1-866-569-1162

Fax: 301-402-8182

Email: nkdep@info.niddk.nih.gov

Internet: www.nkdep.nih.gov

American Kidney Fund

11921 Rockville Pike, Suite 300

Rockville, MD 20852

Phone: 1-800-638-8299

Internet: www.kidneyfund.org

National Kidney Foundation

30 East 33rd Street

New York, NY 10016-5337

Phone: 1-800-622-9010 or 212-889-2210

Fax: 212-689-9261

Internet: www.kidney.org

To get more information about taking care of diabetes, contact

National Diabetes Information Clearinghouse

1 Information Way

Bethesda, MD 20892-3560

Phone: 1-800-860-8747

TTY: 1-866-569-1162

Fax: 703-738-4929

Email: ndic@info.niddk.nih.gov

Internet: www.diabetes.niddk.nih.gov

National Diabetes Education Program

1 Diabetes Way

Bethesda, MD 20814-9692

Phone: 1-888-693-NDEP (1-888-693-6337)

TTY: 1-866-569-1162

Fax: 703-738-4929

Email: ndep@mail.nih.gov

Internet: www.ndep.nih.gov

www.yourdiabetesinfo.org

American Diabetes Association

1701 North Beauregard Street

Alexandria, VA 22311

Phone: 1-800-DIABETES (1-800-342-2383)

Email: askADA@diabetes.org

Internet: www.diabetes.org

JDRF

26 Broadway, 14th Floor

New York, NY 10004

Phone: 1-800-533-CURE (1-800-533-2873)

Fax: 212-785-9595

Email: info@jdrf.org

Internet: www.jdrf.org

More in the Series

The Prevent Diabetes Problems Series includes seven booklets that can help you learn more about how to prevent diabetes problems:

- *Prevent diabetes problems: Keep your diabetes under control*
- *Prevent diabetes problems: Keep your eyes healthy*
- *Prevent diabetes problems: Keep your feet healthy*
- *Prevent diabetes problems: Keep your heart and blood vessels healthy*
- *Prevent diabetes problems: Keep your kidneys healthy*
- *Prevent diabetes problems: Keep your mouth healthy*
- *Prevent diabetes problems: Keep your nervous system healthy*



For free single copies of these booklets, write, call, fax, or email the

National Diabetes Information Clearinghouse
1 Information Way
Bethesda, MD 20892-3560
Phone: 1-800-860-8747
TTY: 1-866-569-1162
Fax: 703-738-4929
Email: ndic@info.niddk.nih.gov

These booklets are also available at
www.diabetes.niddk.nih.gov.

Acknowledgments

Publications produced by the Clearinghouse are carefully reviewed by both NIDDK scientists and outside experts. The National Diabetes Information Clearinghouse (NDIC) thanks Katherine R. Tuttle, M.D., F.A.S.N., F.A.C.P., of the National Kidney Foundation, Providence Sacred Heart Medical Center, and the University of Washington, School of Medicine, for reviewing the updated version of this publication.

The NDIC also thanks the following people who helped review or field-test the original version of this publication:

For the American Association of Diabetes Educators

Lynn Grieger, R.D., C.D.E.
Arlington, VT
Celia Levesque, R.N., C.D.E.
Montgomery, AL
Teresa McMahon,
Pharm.D., C.D.E.
Seattle, WA
Barbara Schreiner, R.N.,
M.N., C.D.E.
Galveston, TX

For the American Diabetes Association

Phyllis Barrier, M.S., R.D.,
C.D.E.
Alexandria, VA
Linda Haas, Ph.C., R.N.,
C.D.E.
Seattle, WA
Kathleen Mahoney, M.S.N.,
R.N., C.D.E.
Drexel Hill, PA
Randi Kington, M.S., R.N.,
C.S., C.D.E.
Hartford, CT

For the Centers for Medicare & Medicaid Services

Baltimore, MD
Jan Drass, R.N., C.D.E.

For the Diabetes Research Centers

Albert Einstein School
of Medicine
Norwalk Hospital
Norwalk, CT
Jill Ely, R.N., C.D.E.
Sam Engel, M.D.
Pam Howard, A.P.R.N.,
C.D.E.

Indiana University School
of Medicine
Indianapolis, IN
Madelyn Wheeler, M.S.,
R.D., F.A.D.A., C.D.E.

VA/JDF Diabetes Research
Center
Vanderbilt School of
Medicine
Nashville, TN
Ok Chon Allison, M.S.N.,
R.N.C.S., A.N.P., C.D.E.

Barbara Backer, B.S.
James W. Pichert, Ph.D.
Alvin Powers, M.D.
Melissa E. Schweikhart
Michael B. Smith
Kathleen Wolffe, R.N.

For the Grady Health System Diabetes Clinic

Atlanta, GA
Ernestine Baker, R.N.,
F.N.P., C.D.E.
Kris Ernst, R.N., C.D.E.
Margaret Fowke, R.D., L.D.
Kay Mann, R.N., C.D.E.

For the Indian Health Service

Albuquerque, NM
Ruth Bear, R.D., C.D.E.
Dorinda Bradley, R.N.,
C.D.E.
Terry Fisher, R.N.
Lorraine Valdez, R.N.,
C.D.E.

Red Lake, MN
Charmaine Branchaud,
B.S.N., R.N., C.D.E.

For the Medlantic Research Center

Washington, D.C.
Resa Levetan, M.D.

For the Texas Diabetes Council

Texas Department of Health
Austin, TX
Luby Garza-Abijaoude,
M.S., R.D., L.D.

National Diabetes Education Program

1 Diabetes Way

Bethesda, MD 20814-9692

Phone: 1-888-693-NDEP (1-888-693-6337)

TTY: 1-866-569-1162

Fax: 703-738-4929

Email: ndep@mail.nih.gov

Internet: www.ndep.nih.gov

www.yourdiabetesinfo.org

The National Diabetes Education Program is a federally funded program sponsored by the U.S. Department of Health and Human Services' National Institutes of Health and the Centers for Disease Control and Prevention and includes over 200 partners at the federal, state, and local levels, working together to reduce the morbidity and mortality associated with diabetes.

National Diabetes Information Clearinghouse

1 Information Way
Bethesda, MD 20892-3560
Phone: 1-800-860-8747
TTY: 1-866-569-1162
Fax: 703-738-4929
Email: ndic@info.niddk.nih.gov
Internet: www.diabetes.niddk.nih.gov

The National Diabetes Information Clearinghouse (NDIC) is a service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The NIDDK is part of the National Institutes of Health of the U.S. Department of Health and Human Services. Established in 1978, the Clearinghouse provides information about diabetes to people with diabetes and to their families, health care professionals, and the public. The NDIC answers inquiries, develops and distributes publications, and works closely with professional and patient organizations and Government agencies to coordinate resources about diabetes.

This publication is not copyrighted. The Clearinghouse encourages users of this publication to duplicate and distribute as many copies as desired.

This publication is available at www.diabetes.niddk.nih.gov.

This publication may contain information about medications and, when taken as prescribed, the conditions they treat. When prepared, this publication included the most current information available. For updates or for questions about any medications, contact the U.S. Food and Drug Administration toll-free at 1-888-INFO-FDA (1-888-463-6332) or visit www.fda.gov. Consult your health care provider for more information.



National Institute of
Diabetes and Digestive
and Kidney Diseases

NIH Publication No. 14-4281
February 2014

 The NIDDK prints on recycled paper with bio-based ink.