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News Release

Date: November 14, 2007
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Texas A&M Health Science Center Communications

Texas A&M HSC united in prevention, treatment of diabetes

(COLLEGE STATION, TX) — You’ve heard about it, and someone you know may even have it — diabetes.

Diabetes occurs when the body is unable to sufficiently use or produce a hormone called insulin, which allows us to use sugar from our diet as energy. There are two types – Type 1, when the body stops producing insulin and requires insulin injections, and Type 2, when the body produces insufficient insulin to maintain blood sugar.

According to the American Diabetes Association, 7 percent of the U.S. population – 20.8 million children and adults – have diabetes. Unfortunately, while an estimated 14.6 million have been diagnosed, another 6.2 million, or nearly a third, have not.

To increase awareness of the disease, November is designated “American Diabetes Month.” And when it comes to diabetes prevention and treatment, clinicians and researchers at the Texas A&M Health Science Center are at the forefront in the community and the laboratory.

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Overall, the risk for developing Type 2 diabetes increases if you are overweight or obese, do not participate in regular physical activity, have a family history of the disease, or are Hispanic, African-American, Asian or Native American. For those at increased risk, understanding how to reduce your chances of developing it later in life is crucial, said Catherine Oliver, M.Ed., interim health education coordinator for diabetes education at the HSC-Coastal Bend Health Education Center at Corpus Christi.

“If you have already been diagnosed with diabetes, aggressive management of blood glucose levels can prevent or prolong the onset of diabetes-related complications,” Ms. Oliver said.

At least 30 minutes of physical activity in your daily routine can help decrease risk, along with a healthy meal plan high in vegetables and fruits. Besides understanding carbohydrate counting, it is important to regulate how many carbohydrate servings will be consumed per meal.

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“If you have diabetes, a registered dietitian or certified diabetes educator can help you understand the best meal plan for you,” Ms. Oliver said. “Counting carbohydrates and spreading out food intake throughout the day allows for the best blood sugar control.”

For the upcoming holidays, Marianne Grant, R.D., L.D., health educator for diabetes education at HSC-CBHEC, said, “Following a meal plan and incorporating daily physical activity will allow a person with diabetes to enjoy this upcoming holiday season and still control their blood sugar levels.”

Caloric intake can be regulated by controlling portion sizes, thus maintaining a healthy weight. More specifically, a person with diabetes needs to pay attention to the amount of and type of food consumed, as it immediately affects blood sugar levels. First and foremost, always watch portion sizes, especially foods containing carbohydrates.

“Do not skip favorite foods; however, control portion size of those foods and stay within your meal plan,” Ms. Grant said. “By identifying holiday foods that contain carbohydrates and making allowances for them in your daily carbohydrate intake, you can help to better manage blood glucose levels.”

Some holiday foods that can affect blood sugar levels are dressing (stuffing), rolls, sweet potatoes, corn, tamales and seasonal desserts.

“Also, try to maintain a consistent pattern of eating your meals and snacks; it is vital to maintaining desirable blood glucose levels,” Ms. Grant said. “Eat your meals around the same time each day with approximately the same amount of servings of each food type. If a holiday dinner will be delayed, have a small carbohydrate snack at the time of your normal meal to avoid low blood glucose levels and prevent overeating. It is important not to overindulge at meal time as it could cause hyperglycemia (high blood sugar).”

If you happen to overeat at a meal, the holidays are a perfect time to add more physical activities with your family. Walk around the neighborhood and admire the decorations. Organize a family outdoor game like touch football or tag to keep things fun. Get outside and play with the children. Anything that will get you moving is well worth the effort to maintain your blood glucose levels within target range, Ms. Grant said.

Though the holiday season can be hectic, do not forget to monitor your blood glucose levels on a regular basis. For example, before eating macaroni and cheese or homemade stuffing, check your blood glucose so you do not overeat and cause high blood glucose levels.

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Knowing you can eat these foods and still control your blood glucose levels will help you feel better about eating the food and – most importantly – savor every bite.

“Managing your diabetes does not have to be a battle during the holidays, nor does it have to stop you from enjoying a home cooked family meal with everyone’s special dish,” Ms. Grant said. “Just make sure to follow your basic plan of watching your portion size, maintaining consistency, staying active and monitoring your blood glucose levels. This will ensure you can have a healthy and happy holiday season.”

Dental care is particularly important for people with diabetes because they face a higher-than-normal risk of oral health problems, according to the HSC-Baylor College of Dentistry. If blood sugar is not under control, it impairs white blood cells, which are the body’s main defense against bacterial infections that can occur in the mouth.

Uncontrolled diabetes also can decrease saliva flow, resulting in dry mouth. Dry mouth can lead to soreness, ulcers, infections and tooth decay. Inflammation of the gums – gingivitis or periodontitis – can occur because blood vessels thicken and slow the flow of nutrients to and waste products from body tissues, including the mouth. As periodontal disease is a bacterial infection, diabetics may experience more frequent and more severe gum disease.

Dr. Janice DeWald, chair and professor of dental hygiene at HSC-BCD, said that although brushing and flossing are effective measures for reducing the risk of gum disease, additional self-care strategies should be discussed with the dental hygienist or dentist. These measures – combined with regular dental visits – can help people with diabetes prevent periodontal disease.

And, adults aren’t the only ones susceptible to diabetes during the holidays or any time of year.

Physicians are seeing an alarming trend of obesity, metabolic syndrome (a cluster of concurrent conditions that increase the risk for heart disease, stroke and diabetes) and diabetes in children, said Don Wilson, M.D., chair and professor of pediatrics at HSC-College of Medicine.

“The components of metabolic syndrome are increasingly being recognized in children and adolescents,” Dr. Wilson said. “Central obesity, high blood pressure, high triglycerides, LDL (“bad”) cholesterol and insulin resistance are on the rise in our nation’s young people. It is clear genetics and a child’s environment play significant roles in his or her health. That is why parents must ensure they don’t allow a bad situation to get worse.”

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Parents can begin to turn the trend of childhood obesity and diabetes around by encouraging their children to become more active, said Dr. Wilson, an endocrinologist with Scott & White Hospital.

“A quarter of 12- to 21-year-olds report no physical activity, and more than half of children ages 2 to 18 have a television in their bedroom,” Dr. Wilson said. “Children spend an average of 38 hours per week using media, such as television, videos, music, computers and video games. They may not be able to do anything about their genetics, but these are things parents can control.”

Meanwhile, several public health approaches to diabetes prevention and management are being examined in order to reduce the growing prevalence throughout Texas.

In the Lower Rio Grande Valley, the HSC-School of Rural Public Health and HSC-South Texas Center are collaborators in a new Hispanic Aging Initiative by five federal agencies within the Department of Health and Human Services. The Lower Rio Grande Valley (Cameron, Hidalgo, Starr and Willacy counties) is one of eight U.S. sites selected for the project and has selected diabetes as its prime focus.

Nelda Mier, Ph.D., assistant professor in the HSC-SRPH, leads the Lower Rio Grande Valley Community Partnership (LRGVCP) in addressing health disparities for older Hispanics in the Valley area. The LRGVCP includes the HSC-SRPH, HSC-STC, Area Agency on Aging, Migrant Health Promotion, The University of Texas-Pan American Border Health Office, First United Methodist Church, Border Affairs Office of the Texas Health and Human Services Commission, Health Ministries Catholic Diocese of Brownsville, *Nuestra Clinica del Valle*, *Amigos del Valle*, and the Colonias Program of the Center for Housing and Urban Development in the Texas A&M University College of Architecture.

“We are very excited to be part of the HHS Hispanic Aging Initiative and looking forward to meeting other partners from different sites,” Dr. Mier said. “Through our participation in the national workshop and network, we will learn about other partners’ activities, share information and resources, and together, we will be addressing health disparities affecting the Hispanic elderly in America.”

The LRGVCP has determined diabetes to be the greatest concern to aging Hispanic populations in the area. One study of those age 58 and older in Valley *colonias* (economically and socially disadvantaged areas) found a self-reported prevalence of diabetes above 46 percent. The statewide prevalence for those age 65 and older is almost 18 percent.

While there already are programs addressing diabetes in the area, there is a need for interventions with an evidence-based approach to address health disparities specific to this age group. The LRGVCP

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mission is to collaboratively select and culturally adapt an evidence-based, culturally sensitive intervention in response to the disproportionate disease burden among the area's older Hispanic population.

"We believe there is a need for a culturally sensitive, evidence-based diabetes program for elderly Hispanics in the Valley seeking to improve their lifestyle behaviors, as well as their access to influenza and pneumonia vaccinations," Dr. Mier said.

The HSC-STC work by Dr. Mier is among numerous diabetes efforts by the HSC-School of Rural Public Health.

The Mexican-American U.S. Latino Research Center (MALRC) has awarded the School (Drs. Mier, Jane Bolin, Mier and Marcia Ory) a pilot grant to examine differences in hospital treatment associated with lower extremity amputation among diabetics living along the Texas-Mexico border. The CHRISTUS Health System has funded the Southwest Rural Health Research Center (Drs. Bolin, Larry Gamm and Robert Ohsfeldt) to evaluate a newly implemented intervention among uninsured persons with Type 2 diabetes who frequently use the CHRISTUS emergency rooms in the Coastal Bend.

The achievement and maintenance of good nutritional health is a critical component in the prevention and management of diabetes, and Dr. Joseph Sharkey of the HSC-SRPH leads an effort to assess the accessibility, availability, affordability, and acceptability of food stores and food service plans in the Lower Rio Grande Valley. With funding from the U.S.D.A. Research, Innovation and Development Grant in Economics (RIDGE) Program from the Southern Rural Development Center at Mississippi State University, Dr. Sharkey's team successfully has identified and mapped all food stores and food service places in the area.

Dr. Sharkey and Dr. Barbara Sharf of Texas A&M University, with support from MALRC, partnered with Julie A. St. John and *promotoras* at HSC-STC to better understand the context in which families in colonias make food choices.

Various community-based and clinical projects are being conducted in the Brazos Valley, with an emphasis on learning what adaptations need to be made to provide quality programs to a more rural population. For example, Drs. Bolin and Ory and Ms. Kerrie Hora are spearheading the training of local community leaders to teach diabetes self-management education classes in rural clinics and community organizations.

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The Brazos Valley is among three geographic areas in Texas Healthy Lifestyles, a statewide program administered through the Department of Aging and Disability Services, with funding from the Administration on Aging. The HSC-SRPH, through Dr. Ory, is the evaluation team for this initiative, which examines the implementation of an evidence-based program helping persons with diabetes manage their own health. It is coordinated with ongoing efforts conducted through the HSC-SRPH Center for Community Health Development, a Centers for Disease Control and Prevention-funded Prevention Research Center.

Also, soon to be pilot tested is a diabetes education computer touch-screen kiosk for use in rural clinics to reach persons with low literacy levels. Developed by a team of researchers and health educators at the Center for Community Health Development (Drs. Bolin and Ory, with input from other members), the kiosk provides easily understandable material on diabetes topics, with the content consistent with evidence-based best practices for diabetes self-management as established by professional or governmental organizations and current research.

Modules include background on diabetes, such as causes, risk factors, signs and symptoms; diagnosis, testing, treatments and complications; and prevention strategies, tips for lifestyle modification and importance of health behaviors. The kiosk enables users to set goals for behavior changes, diary templates and list of topics to discuss with their physician.

HSC-SRPH investigators are also involved in primary care research that examines new approaches for improving care for persons with diabetes – or at-risk of developing diabetes – in Temple as part of a collaboration with Scott & White Health System in Central Texas. Drs. Ory and Samuel Forjough have overseen a pilot study evaluating whether a PDA (personal digital assistant) enhances self-care activities of diabetics. Already three papers from this study have been published that describe the new technology, demonstrate positive effects on diabetic clinical outcomes, and provide patient feedback on general use and acceptability.

Funded through the Center for Minority Health Disparities is a follow-up research project directed by Drs. Bolin and Forjough that employs self-management models to reduce health disparities in Texas. It will test two diabetes self-management programs in a large health system (Scott & White) within multi-site outpatient clinics across Central Texas.

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HSC-SRPH officials said this study is innovative in its comparison of both behavioral and technological intervention approaches, attention to the public health impact and cost-effectiveness of different intervention approaches, and concern with organizational responses to intervention sustainability. A main goal is to strengthen linkages between clinical and community treatment approaches and the identification of successful treatment strategies in different settings and populations.

Yet another primary care HSC-SRPH study is examining the promotion of walking and other physical activity among obese and diabetic patients in integrated health care plans. Through Drs. Forjough, Chanam Lee of Texas A&M and Ory, this assessment is identifying specific built environmental facilitators of, and barriers to, physical activities in neighborhoods.

These projects demonstrate the breadth of diabetes research and practice programs being conducted through the state by HSC-SRPH researchers and colleagues. What is unique is these projects are occurring within a community-based participatory research perspective whereby community members offer valuable input into the nature of the problem as well as the solution. A recent two-issue series in the *Texas Public Health Association Journal* details this approach and diabetes projects in the area utilizing School resources.

Dr. Sharkey, director of the Program for Research in Nutrition and Health Disparities, leads the multidisciplinary team of HSC-SRPH and Texas A&M investigators who are examining environmental influences on food choice in rural Brazos Valley counties. In particular, they are studying objective and perceived access to nutritional resources that influence the prevention and management of diabetes.

This research has been supported by the Center for Environmental and Rural Health at Texas A&M, the U.S.D.A. RIDGE Program, and the new Program for Rural and Minority Health Disparities Research. Dr. Sharkey will showcase this work at an upcoming diabetes health disparities conference in Nashville, Tenn., which is sponsored by the Meharry-Vanderbilt Alliance.

But, the Brazos Valley and South Texas are not the only areas of diabetes research and prevention for the Health Science Center. In the Panhandle, the HSC-Rural and Community Health Institute (RCHI) assists the 42-bed Palo Pinto General Hospital in Mineral Wells with ongoing reports specific to diabetes measurement in their ambulatory setting, said Kathy Mechler, R.N., M.S., Institute co-director.

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RESEARCH

For diabetics, one of the more common and debilitating complications are foot ulcers, as they are often not found until severe enough to cause ulcers or result in amputations. Research has found diabetics are 30 times more likely to have a leg or foot amputated than those without diabetes.

An international authority on diabetic foot problems, Lawrence Lavery, D.P.M., M.P.H., professor of surgery with the HSC-COM and physician at Scott & White, has authored more than 120 publications involving foot surgery and treatment of diabetic foot pathology. His work recently was recognized with two grants from the National Institutes of Health.

A \$2.3 million award will enable evaluation of methods of pressure relief on healing diabetic foot ulcers, as well as compliance and health economic outcomes. The five-year grant with David G. Armstrong, D.P.M., Ph.D., of Rosalind Franklin University of Medicine and Science, is believed to be the first multi-million dollar award of its kind made exclusively to podiatric researchers as principal investigators.

Dr. Lavery also was awarded a \$1.4 million NIH grant to evaluate prevention strategies for diabetic foot ulcers such as use of a therapeutic sock.

Already, Dr. Lavery and his colleagues have found that a simple temperature monitoring device used as a self-assessment tool can help in preventing diabetic foot ulcers in high-risk patients.

“Infrared temperature home monitoring, in serving as an ‘early warning sign,’ appears to be a simple and useful adjunct in the prevention of diabetic foot ulcerations,” Dr. Lavery said in the January issue of *Diabetes Care*. “Self-care may be the single most important factor in preventing complications in individuals with a high risk for diabetic foot ulceration.”

Meanwhile, in the laboratory, researchers at the HSC-Institute of Biosciences and Technology at Houston reported in the journal *Diabetes* that a gene in the liver and elsewhere in the body, when inhibited or increased, affects fatty liver and diabetes but does not alleviate both diseases at once.

“A general drug that inhibits this gene will cure fatty liver disease in the obese while at the same time aggravate high blood lipids, such as cholesterol and cardiovascular disease, and diabetes – even in people who control their caloric intake,” said Wallace McKeehan, Ph.D., director and professor in the Center for Cancer and Stem Cell Biology at the HSC-IBT and senior author. “A drug enhancing this gene’s activity will prevent waistline fat, heart disease and diabetes but aggravate liver disease if you overeat and are obese.”

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“Take your choice with a single drug,” continued Dr. McKeehan, recommending reduced caloric intake and increased exercise as best methods to prevent fatty liver and diabetes. “Cure fatty liver disease and increase diabetes, or treat diabetes and aggravate fatty liver if you overeat and do not exercise.”

In their study, Dr. McKeehan and his colleagues found that a liver gene receptor caused fatty liver in obese mice when fed a high-calorie, fat-filled diet designed to simulate chronic obesity in humans. Removing the gene coding for the receptor, called *FGFR4*, cured the fatty liver despite the mice remaining obese and on a high-fat diet.

However, while the fatty liver was resolved through this approach, the mice exhibited more severe high blood cholesterol, triglycerides and diabetes. Surprisingly, even non-obese mice with a normal body weight, when fed a normal diet, had increased waistline fat, high blood lipids and diabetes when the *FGFR4* was removed.

After the HSC-IBT researchers returned this gene in the liver of the deficient mice, they again came down with fatty liver if they continued to overeat and become obese. But, restoration of the missing gene only in the liver – not other tissues – did not prevent the increase in waistline fat and diabetes in normal non-obese mice.

FGFR4 in the liver helps temporarily store fat in the organ during “fat” times. The stored fat then disappears during “lean” times, as it is used for energy and muscle mass. *FGFR4* in other tissues, such as muscle, keeps sugar from becoming too high in the blood, a hallmark sign of diabetes.

Obesity from overeating high-fat foods constantly stimulates liver *FGFR4*, overloading the organ’s ability to keep fat for only transient storage. Continual storage taxes the liver and interferes with its other functions, resulting in liver disease.

Obesity also constantly stimulates *FGFR4* at other places in the body trying to lower blood sugar. The overload from constant fat times, combined with the liver’s inability to store more fat, leads to chronic high blood cholesterol and high levels of lipids and sugar, finally resulting in Type 2 diabetes.

This study indicates the efficient use of *FGFR4* in different organs in seemingly opposite mechanisms, Dr. McKeehan said, with a net effect of benefiting a person’s overall health under fluctuating dietary conditions ranging from lean to fat.

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“These research findings are a general lesson in the challenges of rational drug design intended to relieve specific symptoms of complicated syndromes such as metabolic syndrome and cancer,” Dr. McKeehan said.

“Anyone who has had severe side effects from a drug understands the principle. Perhaps someday we can find a combined magic bullet cocktail that will inhibit this liver gene and still cure fatty liver while stimulating this gene at other sites in the body to cure heart disease and diabetes.”

Another HSC researcher, Rajat Sethi, Ph.D., assistant professor of pharmaceutical sciences at the Irma Lerma Rangel College of Pharmacy, has spent the past 15 years understanding the mechanisms responsible for the origin and development of cardiovascular disease and diabetes.

Dr. Sethi is actively involved in developing new treatments for these diseases. One of his patented agents (MC-I) currently is in advanced clinical trials at Duke University for myocardial ischemia reperfusion injury (damage to the heart muscle upon reintroduction of blood flow to it, as in angioplasty). His other patents have shown synergistic hypoglycemic effects (low blood sugar) when MC-I is combined with other hypoglycemic agents in Type II diabetes.

Dr. Sethi also received a patent on the cardioprotective effects of distillers grains in ischemic heart disease. His future studies will investigate the hypoglycemic effects of distillers grains and the effect of distillers grains itself on diabetes-induced cardiovascular dysfunction.

“Diabetes is very common in the United States, especially South Texas,” said Dr. Sethi, whose long-term goal is to develop and promote dried distillers grains as a dietary additive for human consumption.

“It is important for the common public to understand the cardiovascular dysfunctions associated with diabetes,” Dr. Sethi continued. “In addition to controlling diabetes with pills and insulin, it will be useful to be able to develop a dietary additive that can prevent or delay the diabetes-induced progression of heart failure.”

Diabetes may be a debilitating, even deadly, disease, but the Texas A&M Health Science Center is making significant advances, at the bench and at the bedside.

The Texas A&M Health Science Center provides the state with health education, outreach and research. Its six components located in communities throughout Texas are Baylor College of Dentistry, the College of Medicine, the Graduate School of Biomedical Sciences, the Institute of Biosciences and Technology, the Irma Lerma Rangel College of Pharmacy, and the School of Rural Public Health.