



Lowering Risk for Type 2 Diabetes in High-risk Youth

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ABSTRACT

Among children and youth who develop type 2 diabetes (T2DM) there are a number of genetic and environmental factors that lead to a combination of insulin resistance and relative-cell secretory failure of the pancreas. These factors include ethnicity (highest in American Indian youth), obesity, sedentary behavior, family history of T2DM, puberty, low birth weight, intrauterine diabetes exposure and female gender. The American Diabetes Association (ADA) has recommended guidelines to screen children and youth for diabetes risk. School nurses in a National Association of School Nurses' program use the ADA guidelines, and then refer at-risk children to a health care provider for further evaluation and intervention. The HEALTHY trial funded by the National Institutes of Health is assessing whether school-based strategies can reduce diabetes risk. Prevention and intervention of overweight and obesity in children—a risk factor for the development of T2DM in children and youth—is a shared responsibility among parents, schools, health care providers and communities.

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INTRODUCTION

The epidemic of childhood overweight and obesity has become a leading national and international public health issue. The long-term consequences are yet to be realized, although most believe that this issue will adversely affect the health and health care costs in our nation and throughout the world. As a result of obesity, it is estimated that this generation of young people will be the first expected not to live as long as their parents, and for children born in 2000, the lifetime risk of developing diabetes is estimated to be 30% in girls and 40% in boys, if nothing is done.¹

YOUTH AT RISK FOR TYPE 2 DIABETES

Overweight and obese children are presented with multiple co-morbid conditions

that had previously been thought of as diseases of adults, most significant of which is type 2 diabetes (T2DM).²⁻⁵ The SEARCH for Diabetes in Youth Study has helped define the prevalence of diabetes in youth in the United States (U.S.).⁶ SEARCH collected data from six states: California, Colorado, Hawaii, Ohio, South Carolina and Washington to determine the prevalence of diabetes in two age groups (0-9 years and 10-19 years), and

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for non-Hispanic Whites, Hispanics, African Americans, Asian/Pacific Islanders and American Indians. The study determined that race/ethnicity and gender differences accounted for the different prevalence rates of type 1 (T1DM) and T2DM.⁶

In the 0-9 year age group, T1DM accounted for more than 80% in the total cohort. For American Indian children in this age group, T2DM accounted for 13%.

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For the 10-19 year age group, the percentage of T2DM was highest in American Indian youth (76%), 40% in Asian/Pacific Islander youth, 33% in African American youth and 22% in Hispanic youth. T2DM rates were the lowest among non-Hispanic Whites in the 10-19 year age group, accounting for only 6% of diabetes, whereas T1DM accounted for more than 91%. In general, the incidence of T2DM is increasing nationally. In one clinic-based study there was a ten-fold increase over a 12-year period. T2DM now accounts for 15% to 45% of newly diagnosed cases of diabetes,⁷ with the incidence dependent on the ethnicity of the population being studied.

Among children and youth, as in adults, T2DM is due to the combination of insulin resistance and relative β -cell secretory failure. There are a number of genetic and environmental risk factors for insulin resistance and limited β -cell reserve including ethnicity, obesity, sedentary behavior, family history of T2DM, puberty, intrauterine growth retardation, intrauterine diabetes exposure and female gender. Environmental factors also play a key role in development of diabetes. Globalization and industrialization are making high-density, low-nutrient food and drinks available to people worldwide and also are responsible for an increasing tendency for children to be sedentary and unfit. This combination of factors has led to a global epidemic of obesity as a major risk factor for T2DM.

SCREENING CHILDREN AT RISK FOR TYPE 2 DIABETES

American Diabetes Association (ADA) guidelines⁸ recommend screening for T2DM in children if they are 10 years of age or when puberty occurs, and should be repeated every two years if children have a body mass index (BMI) at or greater than the 85th percentile for age and gender and have two or more of the following risk factors:

- Family history of T2DM in a first or second degree relative
- High risk race/ethnicity (Native American, African American, Hispanic/Latino, Asian American, Pacific Islander)

- Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans [a light brown-black, rough or thickened are on the surface of the skin], hypertension, high cholesterol and/or triglycerides, or polycystic ovary syndrome [changes in hormone levels])

- Maternal history of diabetes or gestational diabetes mellitus

Children identified as being at risk should be referred to a health care provider for further assessment and implementation of preventive or treatment measures. Diagnosis of T2DM is confirmed with a fasting plasma glucose because of ease of administration, compared to a two-hour glucose tolerance test.⁸ The A1C test may be an adjunctive test to diagnose diabetes in the future.

LOWERING THE RISKS FOR T2DM IN CHILDREN: SAMPLE APPROACHES

Prevention and intervention of overweight and obesity in children is a shared responsibility among parents, schools, health care providers and communities. Because children spend so much of each day at school, "schools are one of the primary locations for reaching the nation's children and youth."⁹

One example of a school-based project is the National Association of School Nurses' (NASN) Managing and Preventing Diabetes and Weight Gain (MAP) program. This five-year program is funded by the CDC Division of Diabetes Translation's "National Program to Promote Diabetes Education Strategies in Minority Communities: The National Diabetes Education Program." The focus of this program, currently being implemented at four large urban school districts and in one state, is to *use the intimate and credible relationships school nurses have with the communities they serve to strengthen and encourage positive behaviors in the prevention and management of diabetes*. Note that whereas the MAP program addresses both management and reducing the risk of diabetes in children and adolescents at school, the current paper focuses only on lowering risk for T2DM in high-risk youth.

School nurses in this program are first provided with the education, tools and resources to understand the scope of the problem, screen students and make appropriate referrals through a standardized continuing education program. Ongoing support is provided by a diabetes prevention resource nurse who has content, clinical and coaching expertise. Participating school nurses at each MAP affiliate site who have completed the required education conduct BMI screenings for third-grade through fifth-grade classes. A student with a BMI at the 85th percentile or greater (for age and gender) is further screened for the presence of additional risk factors such as family history, belonging to a high-risk racial or ethnic group, signs of insulin resistance, or maternal history of diabetes or gestational diabetes.

Students identified as high risk are referred to primary health care providers for additional assessment and implementation of preventive or treatment measures if necessary using a MAP referral form that includes recommended next steps developed by the American Diabetes Association and the American Heart Association. Concurrently, school nurses communicate with students' families about the health of their child (including use of a MAP form), connect high-risk students and families with community resources, advocate for change in school health policies, and participate in local and state coalitions related to childhood overweight and T2DM. School nurses also are provided with resources to facilitate classroom education on healthy lifestyles for targeted classes.

School nurses at MAP affiliate sites are recognized as key partners in addressing the issue of childhood overweight and obesity at the local and state levels, as noted by their active coalition involvement. They also are recognized at the national level. School nurses have been invited to participate in the U.S. Surgeon General's national tour "Childhood Overweight and Obesity Prevention Initiative 'Healthy Youth for a Healthy Future'" which highlights those communities with effective prevention programs. The Surgeon General has indicated to the National



Association of School Nurses that a nurse should be present at all state discussions about childhood obesity. To date, school nurses have participated in discussions in New Mexico, Texas, Alabama, South Dakota, Virginia, Georgia and Rhode Island.

Another example of an approach to lower the risk of T2DM in youth is the HEALTHY trial. The National Institutes of Health is funding the HEALTHY trial to determine if school-based strategies can reduce risk factors for diabetes in a large cohort of middle school students. The main risk factor of interest is a BMI > 85th percentile. The HEALTHY trial began in 2006 in seven sites and involves 42 schools, half of which are in the intervention and half in the control arms. The study group is working with the school staff in the intervention schools to help change cafeteria offerings, as well as the competitive food offerings. The study group also is working with physical education staff to enhance lesson plans and teaching methods to increase moderate to vigorous physical activity during physical education classes. A ten-week classroom curriculum to enhance behavior change is offered over five semesters, focusing on increasing water intake, active versus sedentary behavior, food quality, and energy balance and maintaining a healthy lifestyle. There are a series of school-wide campaigns that employ a number of strategies to get student, parent or guardian, and teacher buy-in in healthy behaviors. This comprehensive school approach aims to reduce risk factors for diabetes. The outcome assesses at-risk levels of BMI between the intervention and comparison schools, as well as elevated fasting plasma glucose and insulin levels.

In anticipation of the full trial, data were collected in a cohort of eighth-graders in predominantly minority schools, and results were published in *Diabetes Care* in 2006.¹⁰ The goal was to determine how

many eighth-grade students had diabetes or abnormalities of glucose or insulin levels measured while fasting and with an oral glucose tolerance test. Data were collected during school from more than 1,700 students in 12 middle schools in three clinical centers. Almost 50% had a BMI greater than the 85th percentile, 39% had a fasting glucose level in the abnormal range compatible with impaired fasting glucose (between 100-126 mg/dl), and 36% had what was considered a high fasting insulin level (greater than 30 uU/ml). Insulin and glucose levels increased with increasing BMI percentile, and fasting glucose was highest in Hispanic and Native American students. This pilot showed that there is a high prevalence of risk factors for diabetes in middle school students in schools with a high minority census; however, few students (less than 1%) were found to have undiagnosed diabetes.

RESOURCES FOR HIGH-RISK YOUTH

National Association of School Nurses (NASN)

- Tools to manage and prevent diabetes: <http://www.nasn.org/Default.aspx?tabid=324>
- School Nurse Childhood Obesity Prevention Education: <http://www.nasn.org/Default.aspx?tabid=435>

National Diabetes Education Program (NDEP)

- *Tips for teens-lower your risk for type 2 diabetes*: <http://www.ndep.nih.gov/publications/PublicationDetail.aspx?PubId=103>
- *Move it! and reduce your risk of diabetes school kit*: <http://www.ndep.nih.gov/publications/PublicationDetail.aspx?PubId=96>

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) Weight Information Network

- Resources for children and adolescents: <http://win.niddk.nih.gov/publications/index.htm#public>

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