

Promoting Prevention, Identification, and Treatment of Prediabetes and Type 2 Diabetes in Youth

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In this issue of *Pediatrics*, Wallace et al¹ describe the accuracy of professional recommendations for screening to identify laboratory test results indicative of prediabetes and type 2 diabetes in youth. Screening guidelines for prediabetes and type 2 diabetes recommend youth aged ≥ 10 years (or at the onset of puberty if that occurs first) with a BMI ≥ 85 th percentile and at least 1 risk factor for developing type 2 diabetes are screened (Table 1).² Fasting plasma glucose, oral glucose tolerance test 2-hour plasma glucose, or glycohemoglobin A1c are used to test for prediabetes or diabetes.² This recommendation is considered controversial by some because the majority of youth with a BMI ≥ 85 th percentile and 1 risk factor do not develop type 2 diabetes during childhood or adolescence. Nonetheless, pediatricians on the front lines are navigating how to best identify and treat rapidly increasing numbers of youth who develop prediabetes and type 2 diabetes.

Diabetes is a devastating public health problem. More than 10% of the US population have diabetes; more than one-third have prediabetes.³ Likewise, diabetes is a common disease in children, affecting $\sim 0.25\%$ of the pediatric population (~ 1 of 400).³ In the current study, 0.48% (~ 1 of 210) of the study population aged 10 to 19 years were already known to have diabetes.¹ Most cases in youth do not go undetected because the majority are

autoimmune-mediated type 1 diabetes and present with polyuria, polydipsia, and weight loss. Type 2 diabetes often presents without symptoms and is a rising threat. In the United States, between 2014 and 2015, the estimated number of new cases of diabetes in youth aged < 20 years was 24 049.^{3,4} Of these, 5758 (24%) were type 2 diabetes. Among youth aged 10 to 19 years, type 2 diabetes incidence increased from 9.0 per 100 000 in 2002–2003 to 13.8 per 100 000 in 2014–2015.⁴ The rates of increase are significantly higher in people of color. Prediabetes is present in up to 1 in 5 youth aged 12 to 18 years and 1 in 4 young adults aged 19 to 34 years.⁵

Prediabetes is a risk factor for type 2 diabetes and is defined as the presence of impaired fasting glucose (fasting plasma glucose between 100 and < 126 mg/dL), impaired glucose tolerance (IGT) (a 2-hour plasma glucose after a 75 g oral glucose tolerance test of 140–199 mg/dL), or hemoglobin A1c (HbA1c) between 5.7% and 6.4%.⁶ These definitions apply for all ages, despite the fact that the epidemiological studies that formed the basis for these definitions did not include pediatric populations. Therefore, the correct application of these definitions for pediatric populations remains unclear. Still, youth with HbA1c in the prediabetes range and/or meeting IGT criteria demonstrate impaired pancreatic β -cell function (a principal component of the

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TABLE 1 Risk-Based Screening Criteria for Prediabetes and Type 2 Diabetes in Asymptomatic Youth With BMI \geq 85th Percentile

Maternal history of diabetes or GDM during the child's gestation ^a
Family history of type 2 diabetes in a first- or second-degree biological relative ^a
Race and/or ethnicity: American Indian, African American, Hispanic, Asian American, and/or Pacific Islander ^a
Conditions associated with or markers of insulin resistance ^b
Acanthosis nigricans
Primary hypertension
Dyslipidemia
Polycystic ovary syndrome
History of small for gestational age or intrauterine growth restriction

Pubertal youth are at the highest risk. Recommendations are to begin screening at age 10 years or at the onset of puberty if this occurs earlier. GDM, gestational diabetes mellitus.

^a Risk factor is supported with clear evidence from well-conducted, generalizable randomized controlled trials that are adequately powered; supportive evidence from well-conducted randomized controlled trials that are adequately powered; compelling nonexperimental evidence.

^b There is supportive evidence from well-conducted cohort or case-control studies.

pathophysiology of type 2 diabetes), visceral adiposity, and increased risk markers for cardiovascular disease compared with those with normal HbA1c.⁷

Although the likelihood that prediabetes in youth will progress to type 2 diabetes is not established, a prospective study of 117 youth with obesity (mean age of 12.5 years) revealed that, of the 33 (28%) with IGT at baseline, 8 (24.2%) progressed to type 2 diabetes and 15 (45%) had normal glucose tolerance after 2 years.⁸ A higher BMI, IGT, and African American race were predictive of progression. Youth with type 2 diabetes have more rapidly progressive disease compared with adults, and oral diabetes medications often fail, leading to the need for insulin therapy at or within a few years of diagnosis.⁹ Earlier treatment of progressors to type 2 diabetes can prevent metabolic derangements, including diabetic ketoacidosis, and delay the onset of complications.

It is suggested that the current screening recommendations are not sensitive or specific enough to identify the population truly at risk and perhaps bring additional burden to the health care system. The recommendations, as applied in the current evaluation, had low

sensitivity and specificity for predicting who would actually have abnormal screening laboratory values.¹ It should be acknowledged that, at any one time, a laboratory test in the prediabetes range is considered an additional risk factor. Worsening dysglycemia and progression toward type 2 diabetes can only be established with follow-up. Although more effective algorithms to determine who should have laboratory testing could be useful, for youth with obesity and multiple risk factors for developing type 2 diabetes, the principal challenge is how to effectively prevent or delay this disease for them and future generations. Pediatricians are encouraged to screen for prediabetes and type 2 diabetes according to professional recommendations with simple clinical tests, such as HbA1c.² Screening and education about prediabetes alone can lead to better rates of follow-up for obesity.¹⁰ Early intervention with education and implementation of prevention strategies according to guidelines for treating youth with prediabetes is encouraged.¹¹ The pediatric health care community should strive to promote policies for the prevention of obesity, prediabetes, and type 2 diabetes when possible, identify type 2 diabetes earlier rather than later, and treat it expediently.²

ABBREVIATIONS

HbA1c: hemoglobin A1c

IGT: impaired glucose tolerance

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