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Identifying Children at Risk for Type 2 Diabetes in Underserved Communities

Eva M. Vivian, PharmD,

University of Wisconsin-Madison, School of Pharmacy, Madison, Wisconsin

Aaron L. Carrel, MD, and

School of Medicine and Public Health, Pediatrics Department, Madison, Wisconsin

Tara Becker, PhD

School of Medicine and Public Health, Biostatistics and Medical Informatics, Madison, Wisconsin

Abstract

Purpose—The purpose of this study was to identify and assess health behaviors among ethnic minority children at high risk for type 2 diabetes.

Methods—Diabetes screenings were conducted at community centers, churches, and local neighborhood health fairs in Madison, Wisconsin. During these events, diabetes risk assessment surveys were given to parents of children between the ages of 10 to 19 years. Parents who identified their children as having 2 or more risk factors for type 2 diabetes were invited to have their child screened for type 2 diabetes.

Results—A total of 86 children between the ages of 10 to 19 years (mean age = 13; 58% male) were screened for diabetes. Fifty-one percent of the children were overweight or obese with 38% having >3 risk factors for type 2 diabetes. While there was no significant difference in the nutritional habits reported between normal, overweight, or obese children, fewer overweight and obese children reported exercising at least 30 minutes 5 to 7 days a week compared to children with a normal weight ($P = .033$).

Conclusion—Prevention of diabetes is a powerful public health intervention. Targeted diabetes screening in disadvantaged, underserved communities is an effective way to identify families with children at risk for type 2 diabetes. In addition, information obtained from these screenings can assist researchers and clinicians in designing accessible and affordable health promotion interventions that are culturally relevant to the youth and families within the community.

In 2005, the Centers for Disease Control and Prevention (CDC) reported that 1 in 3 children born in 2000 would develop type 2 diabetes.¹ Type 2 diabetes is most prevalent among obese adolescents from ethnic minority groups, particularly Native Americans, Hispanics, and African Americans.^{2–5} Overweight adolescents with type 2 diabetes are at risk of developing heart disease and other diabetes related complications before the age of 35 years.^{6–8} These alarming figures, combined with the increase in ethnic minorities in Wisconsin, will result in enormous personal, societal, and economic costs for many decades. Strategies to address this problem are needed immediately, as prevention of diabetes is far preferable to treatment.

Poverty and race are major contributors to health care disparities in the United States. These factors affect where people live, their access to healthy foods, and neighborhood stability, as well as the presence of safe housing, good schools, parks, and recreational areas. In addition, African Americans, Asians, and Hispanic Americans from underserved communities in Wisconsin are less likely to have a usual source of healthcare and more likely to use the emergency room as their source of care.^{9,10} These factors make it difficult to identify, screen, and treat ethnic minority children and adolescents at high risk for developing diabetes.

Currently, 43% of African American children and 23% of Hispanic children in Wisconsin are living in poverty.¹¹ As a result, children from these communities are at an increased risk for poor health outcomes. There is a need for culturally sensitive interventions that target obesity, diabetes, nutrition, and physical activity among African American and Latino children, especially those living in underserved communities. While healthy benefits from school-based programs have been reported,^{12–14} more studies in real world settings that are affordable and accessible are needed to translate research findings into practice.

Community academic partnerships have been found to be an effective means to bridge the gap of health disparities in underserved communities. These partnerships can benefit the university and community by creating innovative and effective ways to provide health related services to ethnic minorities in underserved communities. Utilizing Novel Interventions to Prevent Diabetes in Youth (UNITY) represents a multidisciplinary partnership between the University of Wisconsin-Madison and local community organizations in Madison to screen, identify, and test specific diabetes risk-reduction strategies in adolescents at high risk for developing type 2 diabetes. Adolescents with type 2 diabetes are more likely to be obese, belong to an ethnic minority group, and be sedentary.⁹ It is these very characteristics that allowed us to identify high-risk adolescents for our study.

The UNITY protocol was designed for delivery to low-income African American and Hispanic/Latino American children living in disadvantaged neighborhoods in Wisconsin. This pilot study was conducted in South Madison, Wisconsin, which is an ethnically diverse community that consists of 35% Latinos, 33% African Americans, 10% Asians, 2% American Indians and/or Eskimos, and 20% whites. Screening children at common neighborhood gathering places can be an effective way to identify children at risk for diabetes as well as other chronic illnesses. Our central hypothesis is that community-based screening and recruitment is effective in identifying ethnic minority children at high risk for diabetes and successfully enrolling them in a lifestyle modification program.

Methods

Recruitment and Enrollment

Community screenings were held from March 2008 to July 2009. Diabetes screenings were conducted at several neighborhood community centers, recreational sites, and churches in South Madison for parents of children between the ages of 10 to 19 years. During these neighborhood gatherings, researchers distributed diabetes risk assessment surveys to parents (see Figure 1). Parents who reported their child as having 2 or more risk factors for type 2 diabetes on this survey (overweight [body mass index (BMI) $\geq$ 85th percentile for age and sex]; family history of type 2 diabetes in first or second degree relative; ethnicity; or signs of insulin resistance [acanthosis nigricans, hypertension, polycystic ovarian syndrome, or conditions associated with insulin resistance])¹⁵ were invited to have their child screened for diabetes. The American Diabetes Association (ADA) guidelines indicate that children who are above the 85th percentile for age and gender with additional risk factors should be screened for diabetes. However, we screened normal weight children who had other risk

factors for diabetes so that our screening process would not be stigmatized as screening for “overweight and obese children,” thus preventing embarrassment or discomfort for the overweight and obese children who were being screened at a public event.

The study was approved by the Committee for Protection of Human Subjects at the University of Wisconsin-Madison. Parental consent and child assent was obtained from parents and adolescents who participated in the community screening. Adolescents with diseases that limited their life span or physical limitations preventing regular exercise, type 1 or type 2 diabetes, history of antidiabetic medication use, Cushing’s syndrome, acromegaly, pheochromocytoma, and chronic pancreatitis were excluded from the screening process. Parents, guardians, or children who were unable to communicate with the pertinent clinic staff in English or Spanish were also excluded.

Data Collection

The community screenings were staffed by 2 certified medical interpreters and 3 certified diabetes educators (CDEs), 1 of whom was bilingual/bicultural. All materials were developed in English and Spanish. A nurse CDE, dietitian CDE, and pharmacist CDE administered lifestyle questionnaires and obtained blood pressure and body weight after obtaining written informed consent/assent from children and parents.

The child’s weight and height were measured with the child in a standing position, wearing light clothing, and without shoes. The child’s weight was measured using a digital electronic scale (Conair Body Analysis Weight Tracker Scale, model CON WW89T; Conair, East Windsor, NJ), and height was measured using a portable stadiometer. BMI was calculated as weight (in kilograms) divided by height (in meters) squared.

The blood pressure (BP) and pulse rate were obtained using an ambulatory BP monitor (Omron Digital Blood Pressure Monitor, model HEM-907XL; Omron, Kyoto, Japan), an automatic device that uses an oscillometric technique. Oscillometric devices are easy to use and may be less prone to errors in technique compared to other devices.¹⁶ The child’s blood pressure and pulse were measured 3 times, 1 minute apart, using the protocol recommended by the Task Force Report (National High Blood Pressure Education Program Working Group on Hypertension Control in Children and Adolescents, 1996).¹⁷

Demographic information was obtained from the parents and children. The parent and child were also asked to complete a 15-item lifestyle questionnaire, which included specific questions about nutritional habits and physical activity. These items identified how many days in the past week or month subjects exercised, ate certain foods, or dined at fast food restaurants. Responses ranged from never to 5 to 7 times or days each week. Participants were also asked about their willingness to participate in a family centered diabetes prevention program. The family was given a \$10 gift card for their participation at the completion of the screening process.

Statistical Analysis

Descriptive statistics for the samples of children and parents are presented. Chi-square and Fisher exact tests were used to compare categorical questionnaire responses between BMI groups. All intermediate computations, statistical analyses, and graphical presentations were produced using Stata Software (v10; StataCorp, College Station, TX).

Results

Eighty-six children from 58 families between the ages of 10 to 19 years (mean age = 12.9 [± 2.8] years) participated in this study. Sixty-nine percent were African American, 5%

Native American, 20% white, and 6% other. Forty percent of subjects reported being of Hispanic/Latino heritage. Thirty-three percent of the children were obese (BMI > 95th percentile) and 19% were overweight (BMI > 85th percentile). See Table 1 for other demographic characteristics.

Eighty-seven percent of the children reported that they watched television >2 hours daily. However, 44% of obese children reported watching television >5 hours daily compared to only 21% of overweight children and 26% of normal weight children (Table 2).

While 36% of obese children reported having a regular exercise program, only 14% of obese children reported exercising 5 to 7 times a week compared to 41% of normal weight children and 33% of overweight children ($P = .033$).

Fifty-eight parents (42 women, 8 men, 8 unidentified) participated in the screening process. Thirty-four parents (74% of the 46 parents who provided a report) reported an annual income of less than \$20 000. Seven parents (14% of those who reported their education) reported having a high school education, and 20 (40%) reported having some college education or technical training (Table 3). There was no significant difference in the physical activity levels and nutritional habits reported between parents of normal, overweight, or obese parents.

Discussion

A healthy diet is a key element in reducing the risk of type 2 diabetes. Eating habits, cohesiveness, and emotional stability have a great impact on all family members, especially the adolescent. Parents play a big role in shaping children's eating habits. When parents eat a variety of foods that are low in fat and sugar and high in fiber, children learn to like these foods as well.^{18,19} Several studies have reported that African American children have a higher fat and cholesterol consumption when compared to Caucasian children.^{19,20} This may be due to a lack of parental supervision or cultural beliefs regarding weight. In addition, many parents are not knowledgeable about good nutrition and obtain most of their information from the media, which often provides misleading nutritional information to increase sales and consumption.¹⁸ Over 50% of the children screened in our study reported eating at fast food restaurants 2 to 4 times a week. In addition, parents of obese children reported eating at restaurants more frequently than the parents of normal weight children.

Physical activity has been found to improve insulin resistance, lower blood glucose, and decrease risk of developing type 2 diabetes in children.²¹ In spite of this, many American children are becoming more sedentary for many reasons, some groups more than others. Kimm and colleagues documented a significant decline in levels of physical activity among African American and white girls. However, the decline in physical activity in the African American girls was found to be greater than that of the white girls.²² Factors contributing to this disparity are unknown, but may include fewer physical education programs being offered in high schools in ethnically diverse communities.^{18,21,22} Data from this study showed that, while obese children reported being enrolled in a physical activity program, they did not exercise as frequently as normal or overweight children.

Technology undoubtedly plays a role in decreased physical activity levels as adolescents engage in "screen time," which consists of television, movies, games, and the Internet.¹⁹ Several studies have reported an association between hours of screen time and obesity. Our data showed that obese children were more likely to watch television more hours a day than normal weight children. In addition, over 80% of parents with obese children reported watching television 2 or more hours a day and reported exercising less frequently than

parents of normal or overweight children. Parents can set a good example by going for a walk or bike ride after dinner instead of watching television.

There are significant limitations to our study including a small sample size. Some self-reported data may be inaccurate because subjects may have reported what reflected positively on their own abilities, knowledge, and health beliefs.

Lack of transportation, safety concerns, and cost, as well as social deterrents stemming from being teased or bullied, may prevent overweight youth from participating in school activities or after school programs.^{20,23} This study demonstrates that screening children at neighborhood community centers in disadvantaged communities is an effective way to identify ethnic minority children who are at the greatest risk for type 2 diabetes. In addition, results from the lifestyle questionnaire indicate that these youth would benefit from smaller after school programs that integrate physical activity and health education in a safe, comfortable setting that is culturally acceptable.

Conclusion

Many families in underserved communities are unable to receive health services because of inadequate health insurance coverage. In addition, some clinicians appear unfamiliar with the ADA's screening recommendations for children and adolescents.²⁴ As a result, many children at risk for type 2 diabetes are not appropriately screened.^{24,25} Diabetes screening in underserved communities is a great way to identify families with children who are at risk for diabetes.

More community-based studies are needed that include family education, healthy nutrition, and physical activity. Prevention of diabetes is a powerful intervention and studies designed to target youth at high risk for diabetes in underserved communities is a step toward turning the tide on the public health problem of childhood obesity and diabetes.

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[illegible]

Figure 1.
Is your child at risk for diabetes?

Table 1

Demographic Characteristics of Children

	N	Mean	SD
Age	86	12.93	2.79
Sex	86		
Male	50	58.1%	
Female	36	41.9%	
Racial/ethnic identification	65		
White only	13	20.0%	
Black only	45	69.2%	
American Indian only	3	4.6%	
Black-American Indian	1	1.5%	
White-American Indian	1	1.5%	
Black-white-American Indian	2	3.1%	
Hispanic identification			
Hispanic			
Non-Hispanic			
Weight category (BMI, %)	86		
Normal (<85th percentile, BMI)	42	48.8%	
Overweight (85th–95th percentile, BMI)	16	18.6%	
Obese (>95th percentile, BMI)	28	32.6%	
Blood pressure above 95th percentile	70		
Systolic	16	22.9%	
Diastolic	3	4.3%	

BMI = body mass index.

Table 2

Selected Behavioral Characteristics of Children

	Normal Weight <85th Percentile, BMI		Overweight 85th–95th Percentile, BMI		Obese >95th Percentile, BMI		P Value
	N	%	N	%	N	%	
Watches TV	38		14		23		.449
Less than 2 hours/day	6	15.8%	1	7.1%	3	13.0%	
2–4 hours/day	22	57.9%	10	71.4%	10	43.5%	
5–7 hours/day	10	26.3%	3	21.4%	10	43.5%	
Carries lunch to school	42		16		28		.481
Never	30	71.4%	14	87.5%	21	75.0%	
Ever	12	28.6%	2	12.5%	7	25.0%	
Eats in school cafeteria	42		16		28		.998
Fewer than 4 times/week	12	28.6%	5	31.3%	8	28.6%	
4–6 times/week	8	19.0%	3	18.8%	6	21.4%	
Every day	22	52.4%	8	50.0%	14	50.0%	
Eats at home with family	42		16		28		.756
Once per week or less	3	7.1%	1	6.3%	1	3.6%	
2–3 times per week	8	19.0%	4	25.0%	3	10.7%	
4–6 times per week	5	11.9%	2	12.5%	3	10.7%	
Every day	26	61.9%	9	56.3%	21	75.0%	
Eats fast food	42		16		28		.189
Never	23	54.8%	4	25.0%	13	46.4%	
Once per week	8	19.0%	5	31.3%	10	35.7%	
2–3 times per week	8	19.0%	6	37.5%	5	17.9%	
4 or more times per week	3	7.1%	1	6.3%	0	0.0%	
Regular exercise program	39	41.0%	15	40.0%	22	36.4%	.937
Exercise for at least 30 minutes	39		15		22		.033
Fewer than 2 days/week	8	20.5%	7	46.7%	5	22.7%	
2–4 days/week	15	38.5%	3	20.0%	14	63.6%	
5–7 days/week	16	41.0%	5	33.3%	3	13.6%	
Servings of fruits and vegetables	40		15		23		.801

	Normal Weight <85th Percentile, BMI		Overweight 85th–95th Percentile, BMI		Obese >95th Percentile, BMI		P Value
	N	%	N	%	N	%	
Fewer than 4 servings/week	9	22.5%	3	20.0%	4	17.4%	
4–7 servings per week	8	20.0%	6	40.0%	6	26.1%	
2–3 servings per day	18	45.0%	4	26.7%	9	39.1%	
4–5 servings per day	5	12.5%	2	13.3%	4	17.4%	

BMI = body mass index.

Table 3

Demographic Characteristics of Parents

	N	%
Sex		
Male	8	16.0%
Female	42	84.0%
Unidentified	8	16%
Racial identification	35	
White	12	34.3%
Black	21	60.0%
Native American	2	5.7%
Hispanic identification	47	
Hispanic	19	40.4%
Non-Hispanic	28	59.6%
Education	50	
Less than 9th grade	14	28.0%
Some high school	9	18.0%
High school degree/GED	7	14.0%
Some college/technical school	11	22.0%
Technical degree/associate degree	5	10.0%
Bachelor's degree	0	0.0%
Graduate school	4	8.0%
Employment status	51	
Employed full-time	15	29.4%
Employed part-time	16	31.4%
Not employed	9	17.6%
Disabled	4	7.8%
Other	7	13.7%
Income	46	
Less than \$10 000	21	45.7%
\$10 000–\$19 999	13	28.3%
\$20 000–\$29 999	4	8.7%
\$30 000–\$39 999	2	4.3%
\$40 000–\$49 999	5	10.9%
\$50 000–\$59 999	0	0.0%
\$60 000–\$69 999	0	0.0%

Table 4
Selected Behavioral Characteristics of Parents With Normal, Overweight, and Obese Children

	Normal Weight <85th Percentile, BMI		Overweight 85th-95th Percentile, BMI		Obese >95th Percentile, BMI		P Value
	N	%	N	%	N	%	
Watches TV	17		8		13		.615
Less than 2 hours/day	3	17.6%	2	25.0%	2	15.4%	
2-4 hours/day	10	58.8%	6	75.0%	7	53.8%	
5-7 hours/day	4	23.5%	0	0.0%	4	30.8%	
Eats at a fast food restaurant	24		9		20		.125
Never	1	4.2%	1	11.1%	5	25.0%	
Less than once per month	10	41.7%	1	11.1%	4	20.0%	
Once per month	3	12.5%	2	22.2%	7	35.0%	
Once per week	5	20.8%	3	33.3%	3	15.0%	
2 or more times per week	5	20.8%	2	22.2%	1	5.0%	
Eats at a restaurant	24		9		21		.266
Less than once per month	8	33.3%	1	11.1%	5	23.8%	
At least once per month	9	37.5%	6	66.7%	14	66.7%	
2-3 times per week	6	25.0%	1	11.1%	2	9.5%	
4-6 times per week	1	4.2%	1	11.1%	0	0.0%	
Regular exercise program	22	36.4%	10	30.0%	17	35.3%	.938
Exercise 30 minutes	17		8		13		.776
Fewer than 2 days per week	8	47.1%	4	50.0%	8	61.5%	
2-4 days per week	5	29.4%	2	25.0%	4	30.8%	
5-7 days per week	4	23.5%	2	25.0%	1	7.7%	
Servings of fruits and vegetables	17		8		13		.503
Fewer than 4 servings per week	7	41.2%	1	12.5%	2	15.4%	
4-7 servings per week	3	17.6%	2	25.0%	1	7.7%	
2-3 servings per day	6	35.3%	4	50.0%	8	61.5%	
4-5 servings per day	1	5.9%	1	12.5%	2	15.4%	
Checks food labels	24		10		21		.970
Never	5	20.8%	3	30.0%	7	33.3%	

	Normal Weight <85th Percentile, BMI		Overweight 85th–95th Percentile, BMI		Obese >95th Percentile, BMI		P Value
	N	%	N	%	N	%	
Less than twice per week	6	25.0%	1	10.0%	3	14.3%	
2–3 times per week	6	25.0%	2	20.0%	3	14.3%	
4–6 times per week	1	4.2%	1	10.0%	1	4.8%	
Every day	6	25.0%	3	30.0%	7	33.3%	
Eats at home with family	24		10		20		.320
Fewer than 4 times per week	3	12.5%	2	20.0%	0	0.0%	
4–6 times per week	5	20.8%	3	30.0%	5	25.0%	
Every day	16	66.7%	5	50.0%	15	75.0%	

BMI = body mass index.