

Pediatricians' Perceptions and Practices Regarding Prevention and Treatment of Type 2 Diabetes Mellitus in Children and Adolescents

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Objective: To assess pediatricians' perceptions and practices regarding the prevention and treatment of type 2 diabetes mellitus in children and adolescents in a cross-sectional study.

Design: A 3-wave mailing of a questionnaire to 550 pediatricians. Descriptive statistics, analysis of variance, and logistic regression were used for data analyses.

Setting: A national random sample of pediatricians who work in private practice, hospital settings, and/or clinics.

Results: Every 1 in 9 respondents referred their patients with type 2 diabetes mellitus for exercise, while most pediatricians referred their patients for dietary interventions (62.3%) and educational services (62.6%). Pediatricians who were confident during counseling and follow-up were significantly ($P = .02$) more likely than pediatricians who were less confident to refer their patients for exercise, dietary interventions, and educa-

tional services. Of the respondents, 15.3% perceived they were well prepared to counsel and provide follow-up to patients with type 2 diabetes mellitus. The leading perceived barriers to counseling and follow-up were inadequate time for counseling, poor adherence of patients, lack of family support, lack of familiarity of clinical practice recommendations, and lack of health care insurance coverage.

Conclusions: Pediatricians who had a higher perceived confidence level and who perceived they were better prepared for the counseling and follow-up of patients with type 2 diabetes mellitus had a greater potential to positively affect their diabetic patients. Improving continuing medical education and residency-based programs is imperative to adequately address the emerging epidemic of type 2 diabetes mellitus in children and adolescents.

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AN ALARMING INCREASE in the frequency of type 2 diabetes mellitus in children and adolescents has been recently reported in America.¹⁻³ Type 2 diabetes mellitus accounts for 33% to 46% of all diagnosed cases of diabetes mellitus in children and adolescents between the ages of 10 and 19 years.^{4,5} The prevalence of type 2 diabetes mellitus in children and adolescents has been estimated between 2 and 50 cases per 1000 in various populations, representing a 10-fold increase during the past 2 decades.^{4,5} Type 2 diabetes mellitus has been associated with multiple comorbidities, and children with multiple chronic conditions have had severe long-term consequences.^{6,7} Considering the future economic burden and the subsequent loss of productivity as adults because of premature morbidity, type 2 diabetes mellitus in children is considered a major public health problem in the United

States.^{6,8-10} This epidemic, along with the disparity in health status among racial and ethnic groups, presents an even greater challenge.¹¹⁻¹⁴ Pediatricians are in a prime position to recognize, treat, and educate children and their families.¹⁵ This suggests the importance of examining physicians' perceptions and practices regarding the treatment of type 2 diabetes mellitus, especially with respect to current recommendations regarding type 2 diabetes mellitus in children and adolescents published by the American Diabetes Association (ADA).¹⁵

This study assesses the following: (a) pediatricians' referral practices of patients with type 2 diabetes mellitus regarding exercise, dietary interventions, and educational services; (b) perceived barriers in referring patients with type 2 diabetes mellitus for exercise, dietary interventions, and educational services; (c) pediatricians' perceptions and knowledge of the ADA clinical practice recom-

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recommendations for type 2 diabetes mellitus; (d) screening practices; (e) perceived efficacy expectations (confidence in one's ability) regarding counseling and follow-up of at-risk patients or those with type 2 diabetes mellitus with respect to exercise, dietary interventions, and educational services; and (f) perceived barriers to the counseling and follow-up of at-risk patients or patients with type 2 diabetes mellitus.

METHODS

CONSTRUCTION OF A QUESTIONNAIRE

A comprehensive review of the literature on type 2 diabetes mellitus was completed to help establish the validity of the questionnaire items. Subsequently, the questionnaire was constructed through information obtained from this search and inclusion of the ADA clinical practice recommendations.¹⁶ Per these recommendations, the ideal treatment goal is normalization of serum glucose and glycosylated hemoglobin values. The criteria for diagnosis are as follows: symptoms of diabetes mellitus and a casual (any time of day without regard to time since the last meal) plasma glucose concentration of 200 mg/dL or higher (≥ 11.1 mmol/L), a fasting (no caloric intake for at least 8 hours) plasma glucose concentration of 126 mg/dL or higher (≥ 7.0 mmol/L), and a 2-hour plasma glucose concentration of 200 mg/dL or higher during an oral glucose tolerance test. Overweight children and adolescents (those with a body mass index >85 th percentile for age and sex) or those whose weight is greater than 120% of ideal for height should be tested if they have any 2 of the following risk factors: a family history of type 2 diabetes mellitus in a first- or second-degree relative; a race or ethnicity of American Indian, African American, Mexican American, or Asian or Pacific Islander; signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, or dyslipidemia); or age of 10 years or older or the onset of puberty (if it occurs at an age <10 years). According to the ADA, the testing should be conducted every 2 years, and the preferred method is the fasting plasma glucose test. Patients not ill when diagnosed as having diabetes mellitus can be cared for by nutrition therapy and exercise. The only Food and Drug Administration–approved drug for use in children is insulin. Per the ADA, self-management includes self-monitoring of serum glucose levels, medical nutrition management, and physical activity or exercise.

The instrument was a combination of selected-response questions (Likert-type scale), closed-ended questions (yes or no, circle one, or check all that apply), and fill in the blank questions. The content validity of the instrument was established by sending the questionnaire to a panel of 5 experts in the area of pediatrics, diabetes mellitus, or survey research.^{17,18} The internal reliability, based on the average interitem correlation, was established using the Cronbach α .^{17,18} An overall reliability coefficient for the questionnaire was 0.84. Internal reliability coefficients were also calculated for each of the 7 subscales: (1) stages of change relative to referral for exercise, dietary interventions, and educational services to other health professionals (0.86)¹⁹; (2) perceived barriers to referring patients with type 2 diabetes mellitus to other health professionals for exercise, dietary interventions, and educational services (0.84); (3) how well prepared pediatricians believed they were for the counseling and follow-up of patients with type 2 diabetes mellitus (0.85); (4) current screening practices (0.79); (5) familiarity with the ADA clinical practice recommendations (0.76); (6) perceived level of confidence (efficacy expectations) of pediatricians regarding the counseling and follow-up of patients with type 2 diabetes mellitus (0.91); and (7) perceived barriers to

the counseling and follow-up of patients with type 2 diabetes mellitus (0.88).

The stability of the instrument was established through use of a test-retest with a convenience sample of 20 pediatricians.¹⁷ The results using Pearson product moment correlation coefficients indicated an overall mean coefficient of stability of 0.78.¹⁷

SELECTION OF SUBJECTS

A power analysis was conducted, and a minimum of 285 responses were required to achieve an effect size of $d=0.50$, with a power of 0.95 using 2-tailed tests with an α level of .05.¹⁸ Taking into consideration unusable returns, a random sample mailing list of 550 pediatricians from the American Academy of Pediatrics was obtained. Excluded from the list were all specialists who might not treat children with type 2 diabetes mellitus and pediatricians who may not be treating patients. In addition, physicians had an opportunity for self-exclusion from completing the survey.

Of the 550 questionnaires, 66 (12.0%) were returned in which pediatricians excluded themselves from the study and 56 (10.2%) were returned because of inaccurate addresses. Of the remaining 428 eligible pediatricians, 299 returned the questionnaire (69.9% response rate).

DATA COLLECTION

A 3-wave mailing was used for data collection in an effort to increase response rates.²⁰⁻²² The first wave was sent by first-class mail to everyone on the initial random-sample mailing list. The first wave consisted of a hand-signed cover letter, a copy of the questionnaire printed on colored paper in a 4-page booklet format, a return stamped envelope, and a \$1 monetary incentive. The second mailing was sent 2 weeks later to those who had not yet returned the survey. This mailing included the previously mentioned enclosures, except for the monetary incentive. A postcard reminder was mailed 2 weeks after the second mailing, encouraging respondents to complete and return the survey.

STATISTICAL ANALYSIS

Referral of patients with type 2 diabetes mellitus for exercise, dietary interventions, and educational services was assessed using the stages of change model.¹⁹ Respondents were asked to select the stage of referral practices, from precontemplation (not considering taking any action in the next 6 months) to action (providing referral services).

Analyses of variance¹⁸ were conducted to determine if there were significant differences between pediatricians' referral practices for exercise, dietary interventions, and educational services by how well prepared they perceived themselves for treating children and adolescents with type 2 diabetes mellitus. Analyses of variance were also used to determine significant differences between pediatricians' efficacy expectations (confidence levels) and referral behaviors and perceived level of preparation.

Physicians' knowledge of the ADA clinical practice recommendations was measured using a series of 8 items (12 responses) in which respondents were asked to select the answer that accurately reflects the ADA clinical practice recommendations for children and adolescents with type 2 diabetes mellitus. All items, except for one, allowed the respondent to choose "not sure" as an option. The one that did not instructed the respondents to check all that apply from a list of risk factors associated with type 2 diabetes mellitus in children and adolescents. Knowledge scores were thereafter calculated for each respondent. The total possible score was 12

(range, 0-12). Once calculated, group means were compared for 4 different variables (screening practices, board certification, efficacy expectations, and referral practices). Subsequently, *t* tests were calculated to determine if there were significant differences based on physicians' knowledge of the ADA clinical practice recommendations.

Bivariate logistic regression analyses were used to determine if significant differences existed between perceived level of preparation and selected demographic variables.¹⁸ The Wald statistic was used to analyze relationships between the dependent (or response) variable and independent (or explanatory) variables. The Wald statistic is used when the dependent variable is categorical, while the independent variables may be categorical or continuous. A statistic is generated for each independent variable, controlling for all other variables in the analyses, to determine if significant differences exist and, if so, where those differences exist. Odds ratios (ORs), with a 95% confidence interval (CI), are thereafter produced indicating the likelihood, or odds, of how much the dependent variable affects the various levels of the independent variable.¹⁸

RESULTS

DEMOGRAPHIC CHARACTERISTICS

The respondents were primarily men, aged 40 to 49 years, had practiced from 11 to 20 years, and were in private practice (**Table 1**). Two thirds were treating patients with type 2 diabetes mellitus.

REFERRAL PRACTICES

Most respondents (89.3%) did not refer their patients for exercise, while most did refer their patients for dietary interventions (62.3%) and educational services (62.6%). Pediatricians differed significantly ($P = .03$) regarding referral practices for dietary interventions and educational services based on how well prepared they believed they were for treating children and adolescents with type 2 diabetes mellitus. Pediatricians who perceived themselves as well prepared were significantly more likely than those who perceived themselves as not well prepared to refer their diabetic patients for dietary interventions ($F = 33.55, P \leq .001$) and educational services ($F = 50.76, P \leq .001$).

PERCEIVED BARRIERS TO REFERRAL

There were 7 different choices and an "other" option that respondents could select that reflected their perceived barriers to referring their patients for exercise, dietary interventions, and educational services. Respondents were instructed to check all that applied if they were not referring patients for these services.

The top 4 barriers to referring diabetic patients for exercise were as follows: costs not covered by health insurance (78.2%), lack of family support (52.6%), does not have health insurance (51.2%), and services not covered by insurance (49.5%). The top 4 barriers to referring patients for dietary interventions were as follows: costs not covered by health insurance (31.1%), does not have health insurance (29.1%), lack of family support (23.9%), and lack of community support (17.6%). Last, the top 4 barriers to

Table 1. Demographic Characteristics of the 299 Respondents

Characteristic	No. (%) of Respondents*
Sex	
Male	157 (52.5)
Female	142 (47.5)
Age, y	
30-39	43 (14.4)
40-49	168 (56.2)
50-59	73 (24.4)
≥ 60	15 (5.0)
Time in practice, y	
1-10	61 (20.4)
11-20	171 (57.2)
21-30	53 (17.7)
31-40	14 (4.7)
Geographic location	
Midwest	55 (18.4)
Northeast	52 (17.4)
Northwest	68 (22.7)
Southeast	67 (22.4)
Southwest	57 (19.1)
Training	
Allopathic medicine	292 (97.7)
Osteopathic medicine	7 (2.3)
Board certified	103 (34.4)
Type of employment	
Salaried	140 (46.8)
Self-employed	141 (47.2)
Contract hourly	18 (6.0)
Work setting	
Hospital	45 (15.1)
Clinic	89 (29.8)
Private practice	165 (55.2)
Practice location	
Inner city	35 (11.7)
Urban	79 (26.4)
Suburban	135 (45.2)
Rural	50 (16.7)
How they describe their practice	
Generalist	285 (95.3)
Specialist	14 (4.7)
Have any patients with type 2 diabetes mellitus	
Yes	199 (66.6)
No	100 (33.4)

*Percentages may not total 100 because of rounding.

referring diabetic patients for educational services were as follows: costs not covered by health insurance (34.4%), does not have health insurance (22.8%), lack of community support (22.5%), and lack of family support (18.7%). The 2 barriers least chosen in all 3 categories were as follows: type of insurance reduces referral and disagreement with clinical practice recommendations.

KNOWLEDGE REGARDING THE ADA CLINICAL PRACTICE RECOMMENDATIONS

Most pediatricians responded correctly with respect to the ideal treatment goal for children and adolescents with type 2 diabetes mellitus (normalization of serum glucose and glycosylated hemoglobin values) (81.6%) and the guideline for screening patients for type 2 diabetes mellitus (overweight children aged ≥ 10 years with any

Table 2. *t* Test Results Between Knowledge Scores of 294 Pediatricians and Screening Practices, Board Certification, Efficacy Expectations, and Referral Practices

Variable	No. of Pediatricians	Knowledge Score, Mean (SD)*	<i>t</i> Test Value
Routine screening			
Yes	84	6.29 (1.37)] 43.43†
No	210	4.00 (1.0)	
Board certification			
Yes	100	5.26 (1.62)] 0.02
No	194	5.39 (1.68)	
Efficacy expectations			
High (≥10.0)	178	5.78 (1.42)] 31.01†
Low (<10.0)	116	4.74 (1.75)	
Referral for exercise			
Yes	31	5.46 (1.59)] 0.10
No	263	5.36 (1.69)	
Referral for dietary interventions			
Yes	111	5.66 (1.59)] 15.26†
No	183	4.83 (1.69)	
Referral for educational services			
Yes	110	5.70 (1.64)] 4.86‡
No	184	4.08 (1.49)	

*The potential range of scores was from 0 to 12.

†*P* ≤ .001.

‡*P* ≤ .05.

2 risk factors) (67.7%). In addition, most respondents correctly selected family history (92.9%), obesity (91.5%), race or ethnicity (85.0%), and signs of insulin resistance (85.7%) as risk factors; however, many (61.2%) incorrectly identified hyperlipidemia as a risk factor.

t Test results found statistical differences between pediatricians' knowledge score and screening practices, efficacy expectations, and referral practices for dietary interventions and educational services (**Table 2**). Pediatricians with a higher knowledge score of the ADA clinical practice recommendations were more likely to conduct routine screening for type 2 diabetes mellitus, and were more likely to refer patients for dietary interventions and educational services, than those with a lower knowledge score. In addition, pediatricians with a higher knowledge score were also more likely to be more confident during the counseling and follow-up of patients with type 2 diabetes mellitus.

PERCEIVED LEVEL OF PREPARATION

An examination was conducted of pediatricians' perceptions regarding their level of preparation during the counseling and follow-up of patients with type 2 diabetes mellitus by various demographic variables (sex, age, years of practice, geographic location, type of employment, work setting, practice location, whether they were board certified, and whether they were generalists or specialists). The analyses revealed significant differences based on their perceived level of preparation by age, years of practice, work setting, and practice location. Physicians who were 50 years and older (OR, 2.68; 95% CI, 1.09-11.64) were almost 3 times more likely to perceive themselves as more prepared during counseling and follow-up than those who were younger than 50 years (OR, 1.00; 95% CI, referent). Re-

spondents who practiced for more than 20 years (OR, 2.72; 95% CI, 1.20-16.53) were almost 3 times more likely to perceive themselves as more prepared during counseling and follow-up than those who practiced for 10 years or less (OR, 1.00; 95% CI, referent). In addition, pediatricians who practiced in clinics (OR, 2.47; 95% CI, 1.09-5.61) were 2.5 times more likely to perceive themselves as more prepared during counseling and follow-up than those who were in private practice (OR, 1.00; 95% CI, referent). Last, physicians who practiced in inner-city locations (OR, 2.69; 95% CI, 1.06-6.69) were more than 2.5 times more likely to perceive themselves as more prepared during counseling and follow-up than those who practiced in suburban settings (OR, 2.05; 95% CI, 1.93-4.54), while those practicing in rural settings (OR, 1.00; 95% CI, referent) were 2 times more likely to perceive themselves as more prepared during counseling and follow-up.

SCREENING PRACTICES OF PEDIATRICIANS

The analyses revealed significant differences regarding practice behaviors by sex, age, practice location, and whether pediatricians were board certified. Male respondents were less likely than female respondents to screen patients for type 2 diabetes mellitus (OR, 0.52; 95% CI, 0.33-0.99). Physicians aged between 40 and 49 years were about 3 times more likely to screen than all other age groups (OR, 3.13; 95% CI, 1.16-81.64), as were those who practiced in inner-city locations (OR, 2.86; 95% CI, 1.12-7.27). Last, physicians without board certification were half as likely to conduct routine screening as those with board certification (OR, 0.41; 95% CI, 1.09-1.52).

EFFICACY EXPECTATIONS REGARDING COUNSELING AND FOLLOW-UP

Efficacy expectations (confidence level) regarding the counseling and follow-up of children and adolescents with type 2 diabetes mellitus were measured using a series of Likert-type items. These items addressed their confidence with respect to counseling about exercise, dietary interventions, and educational services. Efficacy expectations were determined by the relative position of a score ranging from 0 to 24. The overall mean (9.95) for the efficacy expectations' subscale was used as the dividing point for confident vs not confident. Those who scored 10 or more were considered confident, while those who scored below 10 were considered not confident.

The analyses revealed that pediatricians who were confident (high efficacy expectations) were more likely to refer their diabetic youths for exercise and educational services (**Table 3**). In addition, the analyses identified that significant differences existed between the pediatricians' confidence levels and how well prepared they believed they were for treating patients with type 2 diabetes mellitus and how much in favor they were of the ADA clinical practice recommendations (Table 3).

PERCEIVED TREATMENT BARRIERS

Respondents were asked to select from a list of 14 choices and another option (all those that were perceived barri-

What This Study Adds

To our knowledge, no other study in the literature has specifically examined pediatricians' perceptions of their preparation to treat youths with type 2 diabetes mellitus. This study found that most pediatricians questioned were in favor of following the ADA clinical practice recommendations; however, only about 15.3% believed they were well prepared and confident to treat and counsel children and adolescents with type 2 diabetes mellitus.

ers to the counseling and follow-up of children and adolescents with type 2 diabetes mellitus). Most respondents selected 6 barrier items: lack of time to counsel patients (82.6%), poor adherence of patients (69.8%), lack of family support (62.3%), lack of familiarity with clinical practice recommendations (58.5%), lack of health care insurance (55.2%), and lack of knowledge regarding nutrition (51.7%).

COMMENT

While the response rate of 69.9% was a good one, those who responded may have had more of an interest in the topic of type 2 diabetes mellitus in children and adolescents than those who did not respond. It is also possible that those who responded were more confident about their knowledge and practice behaviors. If so, then the responses represent unduly positive findings.

The survey targeted only pediatricians from the American Academy of Pediatrics. The pediatricians were instructed to exclude themselves if they were not treating patients (eg, retired members, emeritus members, and resident members of the academy). There was also an attempt to exclude physicians who were specialists in an effort to select only general practitioners more likely to be the first medical practitioner in contact with children and adolescents who were at risk for or had type 2 diabetes mellitus. Although 4.7% of the respondents indicated they were specialists, this study did not target differences between generalists and specialists. This may have caused a perception bias with respect to the screening and treatment practices in children and adolescents with type 2 diabetes mellitus. Based on the study sample, caution should be used in generalizing these results to all pediatricians.

Type 2 diabetes mellitus is strongly linked to lifestyle, and reflects societal patterns favoring obesity and physical inactivity.²³⁻²⁵ Health care providers of children are in a prime position for early recognition of diabetes mellitus and, therefore, have the potential for providing early diagnosis and treatment.^{16,26-28} The study findings provide evidence regarding existing barriers to referral and treatment (counseling and follow-up) practices. While the referral and treatment practices for dietary interventions and educational services are encouraging, further research is necessary to influence practice behaviors with respect to exercise.²⁹⁻³⁵ Exposing potential barriers can help support further research regarding graduate medical education efforts to facilitate the

Table 3. Efficacy Expectations of Pediatricians for the Counseling and Follow-up of Patients With Type 2 Diabetes Mellitus

Variable	Confident*		F Value
	Yes (n = 178)	No (n = 116)	
Referral behaviors			
Exercise	53.3 (6.7)	46.7 (6.4)	1.89†
Dietary interventions	50.5 (3.1)	49.5 (3.8)	1.44
Educational services	58.0 (12.0)	42.0 (12.2)	1.76‡
Perceived level of preparation for counseling and follow-up	59.9 (16.5)	40.1 (12.0)	4.41†
Perceptions toward the ADA clinical practice recommendations	67.9 (24.5)	32.1 (23.5)	3.18†

Abbreviation: ADA, American Diabetes Association.

*Data are given as mean (SD) percentage of pediatricians. The potential range for all variables was from 0% to 100%.

† $P \leq .001$.

‡ $P \leq .05$.

practice behaviors of pediatricians.³⁶ Health care insurance issues are among the top barriers for referring patients for services such as exercise and dietary interventions. Nonwhite culturally diverse groups and women are at a particularly high risk for developing type 2 diabetes mellitus as a result of lifestyle behaviors and less than adequate preventive care services.^{4,12-14,37} Socioeconomic inequalities have been attributed to increased risk factors associated with type 2 diabetes mellitus, such as poor nutrition, being overweight, and increased rates of poor health behaviors.^{4,12-14,27} Because an earlier age of onset increases the likelihood of lifetime incidence of type 2 diabetes mellitus-associated complications, interventions with children and adolescents are likely to be more cost-effective.³⁸ Inadequate health care insurance coverage has been cited as a major barrier to adherence to treatment and follow-up and successful clinical management.^{8-10,12} Therefore, specific programs and strategies are needed to assist pediatricians in recognizing and treating type 2 diabetes mellitus in children and adolescents.

Based on the findings, the following recommendations are offered: (1) examine treatment and prevention practice behaviors of other primary care providers, such as those in family practice, to determine if barriers for type 2 diabetes mellitus extend to other primary care physicians; (2) examine potential alternatives and develop creative policies to health care delivery systems to help remove identified barriers and improve health care access^{12,14,32,33,39}; (3) assess the potential cost benefit of including nutrition and exercise programs targeted toward controlling known risk factors for type 2 diabetes mellitus^{10,29-31,33,34}; (4) develop primary prevention activities, including physician counseling about diet and exercise, and carefully monitored physical activity programs targeted toward at-risk children³⁹; (5) investigate school-based primary prevention programs to increase knowledge and behavioral changes³⁹; (6) assess whether providing residency-based training programs or medical education training programs targeted toward pediatricians regarding the recognition, early diagnosis, and

treatment of type 2 diabetes mellitus in children would change practice behaviors and improve confidence during the counseling and follow-up of their patients; and (7) investigate long-term prevention strategies that consider socioeconomic status, cultural beliefs, and disparities in health care.

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