

Management of Hypertension and High Low-Density Lipoprotein in Pediatric Type 1 Diabetes

Michelle L. Katz, MD, MPH^{1,2}, Zijing Guo, MPH², and Lori M. Laffel, MD, MPH^{1,2}

Objective To evaluate hypertension and hyperlipidemia management patterns in youth with type 1 diabetes and to assess perceived effectiveness of management strategies and barriers to management.

Study design An electronic survey, including clinical scenarios, fielded to pediatric providers (members of the American Diabetes Association Diabetes in Youth Interest Group, Pediatric Endocrine Society, or T1D Exchange).

Results Respondents (N = 207, 86% MDs, 68% female) were practicing clinicians for youth with type 1 diabetes. As an initial recommendation, the overwhelming majority of respondents (83%-99%) endorsed lifestyle and nonmedical recommendations (eg, improve glycemic control) for hypertension and hyperlipidemia. Yet, few (6%-17%) reported these recommendations as effective. Many respondents (57%) reported referring to another specialist for hypertension, whereas few (8%) reported referring to another specialist for hyperlipidemia management. Approximately one-fifth (21%) of respondents never initiate antihypertensive medications, whereas only 8% never initiate lipid-lowering medication. Among prescribers, the majority of respondents only started antihypertensive or lipid-lowering medications after persistent elevations and in the setting of either ineffective lifestyle or nonmedical interventions or additional cardiovascular risk factors. More than two-thirds of respondents endorsed medications as often effective for hypertension and hyperlipidemia (68% and 69%, respectively).

Conclusions Pediatric diabetes providers commonly defer prescribing antihypertensive and lipid-lowering medications until nonmedication interventions have been ineffective. Most providers describe medications, but not lifestyle interventions, as often effective. Efforts to align clinical practice with clinical guidelines are needed. (*J Pediatr* 2017;■■:■■-■■).

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Cardiovascular disease (CVD) affects persons with type 1 diabetes more frequently,¹ at younger ages,² and with greater mortality^{3,4} than persons without type 1 diabetes. Childhood risk factors for CVD such as elevated low-density lipoprotein (LDL) cholesterol or blood pressure (BP) directly relate to early atherosclerosis in young adulthood.⁵ Given elevated future CVD risk in children with type 1 diabetes, national guidelines for the management of hypertension and hyperlipidemia recommend more aggressive management in youth with type 1 diabetes than in youth without type 1 diabetes.⁶⁻⁸

Previous studies describe a gap between clinical guideline recommendations and clinical management of CVD risk factors in youth with^{9,10} and without type 1 diabetes.¹¹⁻¹³ However, it is unclear whether differences between clinical guidelines and clinical practice result from an inadvertent gap between intention and actual practice or whether pediatric diabetes providers' treatment paradigms differ from current guidelines. Furthermore, pediatric diabetes providers' perceptions of the effectiveness of management strategies for hypertension and hyperlipidemia and barriers to management have been described incompletely.

By surveying a broad sample of pediatric diabetes providers, we aimed to assess providers' current management strategies for hypertension and hyperlipidemia in youth with type 1 diabetes. We also aimed to describe the perceived effectiveness of various management strategies and the barriers that prevent optimal management of hypertension and hyperlipidemia in youth with type 1 diabetes.

ADA	American Diabetes Association
AHA	American Heart Association
BP	Blood pressure
CVD	Cardiovascular disease
LDL	Low-density lipoprotein
NHLBI	National Heart, Lung, and Blood Institute

From the ¹Pediatric, Adolescent and Young Adult Section; and ²Section on Clinical, Behavioral and Outcomes Research, Joslin Diabetes Center, Boston, MA

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Methods

This provider survey focused on current management practices for hypertension and hyperlipidemia (high LDL) in youth with type 1 diabetes, including strategies for and barriers to optimal management. The survey was developed with an initial literature review, and then questions were drafted by pediatric endocrinologists with input from a multidisciplinary team, including physicians, nurse practitioners, nurse educators, nutritionists, and mental health professionals, all with pediatric type 1 diabetes expertise. Areas surveyed included provider and practice demographic information, workup for hypertension, management recommendations for hypertension and hyperlipidemia, medication use in these conditions, perceived effectiveness of management recommendations, and barriers to treatment in youth with type 1 diabetes and hypertension or hyperlipidemia.

Because we intended to determine how current management compares with commonly referenced guidelines, we specifically queried recommendations and clinical scenarios that related to popular guidelines as well as other clinical scenarios in which medication initiation might reasonably be considered. The guidelines used for comparison were Standards of Medical Care in Diabetes—2016 from the American Diabetes Association (ADA; referred to as the ADA guidelines⁶), the National Heart, Lung, and Blood Institute (NHLBI) Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents Summary Report (NHLBI guidelines⁷), and Cardiovascular risk reduction in high-risk pediatric patients: a scientific statement from the American Heart Association (AHA) Expert Panel on Population and Prevention Science; the Councils on Cardiovascular Disease in the Young, Epidemiology and Prevention, Nutrition, Physical Activity and Metabolism, High Blood Pressure Research, Cardiovascular Nursing, and the Kidney in Heart Disease; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research (AHA guidelines⁸). Guideline recommendations for youth with type 1 diabetes are summarized in **Table I** (available at www.jpeds.com). Cognitive interviewing was conducted with 2 nurse practitioners and 2 physicians, and the survey was revised iteratively in response to their feedback.

The survey initially included 36 main items and then was consolidated to 33 items to ease respondent burden, given the similarity of responses for barriers to hypertension and hyperlipidemia management. A small number of sections used adaptive questioning to reduce the length of the survey and allow respondents to view only relevant questions. Response options included a 5-point Likert scale (never, rarely, sometimes, often, always), forced choice, or multiple responses allowed depending on the question. Questions included an “other” response with the option for free text if respondents chose. The survey required <10 minutes to complete. The full survey is available in the **Appendix** (available at www.jpeds.com).

The survey was fielded electronically via RedCap (Research Electronic Data Capture)¹⁵ to members of the ADA

Diabetes in Youth Interest Group, Pediatric Endocrine Society, and investigators and coordinators of the T1D Exchange with majority pediatric patients between January 2016 and January 2017. An introductory information letter provided details on survey purpose, anonymity of responses, and the option for nonparticipation with consent implied when respondents opted to proceed with the survey. The invitation to complete the survey was sent via e-mail with a follow-up email sent approximately 2 weeks later with direction to only complete the survey once. Participation also was encouraged at the Diabetes in Youth Interest Group session at the ADA Scientific Sessions in New Orleans, 2016. Physicians, nurse practitioners, physician’s assistants, nurses, or dietitians who cared for more than 10 patients aged 0–25 years with diabetes annually were eligible to participate. A \$5 donation to ADA, Pediatric Endocrine Society, or Life for a Child of the International Diabetes Federation (for T1D Exchange participants) was used to recognize respondents for completing the survey. Before we administered the survey, institutional review board approval was obtained.

For survey responses to be included for analysis, demographic questions and the initial question on evaluation of hypertension must have been answered. For analysis, the 5-point Likert scale was consolidated to a 3-point Likert scale. The categories of never and rarely are referred to as “rarely,” the category of sometimes remains as “sometimes,” and the categories of often and always are referred to as “often.” To combine the questions on barriers for hypertension and hyperlipidemia in the 35 individuals who answered the longer survey with separate barrier questions for each condition, responses were maintained for respondents who answered similarly for both conditions (65% of responses). If respondents answered oppositely for hypertension and hyperlipidemia (rarely vs often), then the responses were excluded (7%). If respondents answered either rarely or often for one condition and sometimes for the other condition, then sometimes was kept as the response (28%).

If respondents used the “other” response option and entered free text, the study team categorized and tabulated responses by consensus. Responses that were highly similar to existing response options were recategorized to the existing option. Free text responses written by $\geq 5\%$ of respondents to a question are reported in the text.

Analyses were conducted in SAS version 9.4 (SAS Institute, Cary, North Carolina). Descriptive analyses were completed for all questions. We conducted χ^2 analyses to determine whether differences in provider or medication barriers varied by provider demographic characteristics (provider age, practice setting, years since training completion, sex, and number of patients under provider’s care). $P < .05$ was considered significant.

Results

The survey was fielded to the 1361 members from American Diabetes Association Diabetes in Youth Interest Group, the 1368

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