

1-1-2018

Changes in the 2017 Pediatric Hypertension Clinical Guidelines.

Bonita Falkner

Thomas Jefferson University, Bonita.Falkner@jefferson.edu

Let us know how access to this document benefits you

Follow this and additional works at: <https://jdc.jefferson.edu/medfp> Part of the [Pediatrics Commons](#)

Recommended Citation

Falkner, Bonita, "Changes in the 2017 Pediatric Hypertension Clinical Guidelines." (2018).
Department of Medicine Faculty Papers. Paper 251.
<https://jdc.jefferson.edu/medfp/251>

This Article is brought to you for free and open access by the Jefferson Digital Commons. The Jefferson Digital Commons is a service of Thomas Jefferson University's [Center for Teaching and Learning \(CTL\)](#). The Commons is a showcase for Jefferson books and journals, peer-reviewed scholarly publications, unique historical collections from the University archives, and teaching tools. The Jefferson Digital Commons allows researchers and interested readers anywhere in the world to learn about and keep up to date with Jefferson scholarship. This article has been accepted for inclusion in Department of Medicine Faculty Papers by an authorized administrator of the Jefferson Digital Commons. For more information, please contact: JeffersonDigitalCommons@jefferson.edu.

CHANGES IN THE 2017 PEDIATRIC HYPERTENSION CLINICAL GUIDELINES

Bonita Falkner, MD

Departments of Medicine and Pediatrics

Thomas Jefferson University

Short title: Pediatric High BP Guideline Updates

Key Words: Children, Adolescents, Blood Pressure, Hypertension

Disclosures: Nothing to disclose

Correspondent

Bonita Falkner, MD

Department of Medicine

Thomas Jefferson University

833 Chestnut St. Ste 700

Philadelphia, PA 19107

Phone: 215-205-2857

FAX: 215-503-2506

Email: bonita.falkner@jefferson.edu

The clinical practice guidelines on diagnosis and management of high blood pressure in children and adolescents have been periodically modified and updated since the original publication in 1977.¹ Since the last pediatric blood pressure guideline was published in 2004, known as the Fourth Report,² the literature on child BP and hypertension has expanded considerably. There has been a recognized need to update the Fourth Report for several years. However, the National Heart, Lung, and Blood Institute (NHLBI) who sponsored previous pediatric BP guidelines announced that NHLBI would no longer sponsor development of new clinical guidelines.³ Subsequently, in 2014 the American Academy of Pediatrics (AAP) agreed to sponsor development of a new pediatric BP clinical practice guideline (CPG). The new CPG for screening and management of high BP in children and adolescents was recently published in *Pediatrics*.⁴ This CPG was developed using the rigorous evidence-based approach recommended by the Institute of Medicine in 2011.⁵ This methodology was consistent with recent NHLBI recommendations on development of CPGs for cardiovascular disease.³ The

new pediatric hypertension CPG contains several modifications from the previous guideline to guide clinicians in diagnosis and management of elevated BP and hypertension in children and adolescents. This summary describes those changes made since the 2004 Fourth Report.

The childhood BP database used to develop normative BP data and BP tables in the previous pediatric BP CPGs included overweight and obese children. Recently, this BP database was reanalyzed by Rosner et al.⁶ who found that when overweight and obese children were excluded the BP levels, adjusted for sex, age, and height, were 2 to 3 mm Hg lower than the values in the Fourth Report. Due to the strong association of excess adiposity with higher BP throughout childhood, it was determined that normative reference data and BP tables should be based on normal weight (body mass index [BMI] <85th %) children and adolescents. The new tables now provide systolic and diastolic BP levels on normal weight children and adolescents according to age, sex, and height at the 50th, 90th, and 95th percentiles, and the 95th+12 mm Hg to denote stage 2 hypertension. Similar to the previous BP tables in the Fourth Report, the new BP tables are precise. However, also similar to Fourth Report tables, they are complex and cumbersome to use in clinical practice. Because it was evident that the detailed tables may have contributed to under-detection of childhood hypertension in clinical practice,⁷ a tool to facilitate detection has been added in the new CPG. It was also recognized that automated BP devices are frequently used in clinical practices, while the BP tables are based on auscultation measurement. To facilitate detection of abnormal BP levels in clinical practices a simplified, easy to use, table that lists systolic and diastolic BP level at the 90th percentile by age and sex is provided for screening purposes in the 2017 CPG. The table uses the BP values at the 90th percentile for children at the 5th percentile for height, which captures all children with BP \geq 90th percentile from shortest to tallest at each age. A BP measurement at or above the 90th

percentile should be repeated and if replicated warrants further measurement by auscultation for confirmation of elevated BP or hypertension.

Since publication of the first pediatric hypertension clinical guideline in 1977¹ the definition of hypertension in childhood has been systolic and/or diastolic BP \geq the 95th percentile which represents the top portion of the normative BP distribution by age and sex. The definition was subsequently adjusted to BP \geq the 95th percentile according to age, sex, and height percentile.² This statistical definition is due to absence of outcome data. Without outcome data, it has not been possible to link a BP level in childhood with risk for hypertension related cardiovascular events later in life. This definition of hypertension remains the same for children <13 years of age which is average systolic and/or diastolic BP \geq 95th percentile on the new BP tables. The term “prehypertension” has been changed to “elevated BP” which is defined as average systolic or diastolic BP \geq 90th and <95th percentile. The definitions of elevated BP and hypertension have changed for adolescents. The 95th percentile for systolic BP among adolescents is close to 130 mm Hg. Therefore, beginning at age 13 years, the definition of elevated BP and hypertension are now numerical values. This change from a percentile to a numerical definition serves to simplify recognition of hypertension in adolescents. These new definitions of elevated BP and hypertension in adolescence are also identical with the new definitions of abnormal BP in the CPG for hypertension in adults developed by the American Heart Association and the American College of Cardiology.⁸ The BP definitions for children and adolescents are summarized as follows:

Children <13 years:

Normal BP = systolic and diastolic BP <90th percentile

Elevated BP = systolic and/or diastolic BP $\geq 90^{\text{th}}$ to $< 95^{\text{th}}$ percentile

Hypertension = systolic and/or diastolic BP $\geq 95^{\text{th}}$ percentile

Stage 1 = systolic and/or diastolic $\geq 95^{\text{th}}$ to $< 95^{\text{th}}$ percentile + 12 mm Hg

Stage 2 = systolic and/or diastolic $> 95^{\text{th}}$ percentile + 12 mm Hg

Adolescents ≥ 13 years:

Normal BP = systolic and diastolic BP $< 120 / < 80$ mm Hg

Elevated BP = systolic and diastolic BP $\geq 120 / < 80$ to $129 / < 80$ mm Hg

Hypertension = systolic and/or diastolic BP $\geq 130 / 80$ mm Hg

Stage 1 = systolic and/or diastolic BP $\geq 130 / 80$ to $139 / 89$ mm Hg

Stage 2 = systolic and or diastolic BP $\geq 140 / 90$ mm Hg

BP measurements in children and adolescents are now recommended only during routine health care visits, unless the patient has chronic conditions requiring more than preventive care and associated with abnormal BP such as obesity, kidney disease, heart disease, or diabetes. The diagnosis of hypertension continues to be based on abnormal BP on three separate clinical visits, unless the patient is symptomatic. BP measurement by auscultation remains the preferred method for confirmation of abnormal BP status because the normative BP tables are based on auscultated BP measurements.

Following publication of the 2004 Fourth report, considerable advancement has developed in application of 24-hour ambulatory blood pressure monitoring (ABPM) in children and adolescents.⁹ The 2017 pediatric CPG now recommends ABPM for confirmation of abnormal BP status in several clinical situations. These include confirmation of the diagnosis of hypertension in patients with repeated abnormal BP measurements, identification of white coat hypertension, and detection of masked hypertension. ABPM has also been found useful in identifying masked hypertension in children with a history of coarctation of the aorta, hypertensive target organ damage (TOD) in children with chronic kidney disease; and evaluating BP status in pediatric heart and kidney transplant recipients. Evaluating treatment effectiveness in patients receiving antihypertensive therapy is another useful application of ABPM included in the 2017 CPG recommendations.⁴ The recommendation to utilize ABPM to develop additional clinical information in children and adolescents with abnormal BP is in line with the United States Preventive Services Task Force recommendation for hypertensive adults.¹⁰ Although adult guidelines also recommend home BP monitoring as an alternative to ABPM for confirmation of hypertension, the evidence on home BP monitoring is limited in children and adolescents. Thus, home BP monitoring for the purpose of determining BP status was not recommended in the 2017 CPG. It was also recognized that ABPM may not be available to many primary care clinicians, which would necessitate reliance on repeated clinic BP measurements or referral to a pediatric subspecialist.

When the 2004 Fourth Report was published, it was recognized that TOD could be detected in some hypertensive children and adolescents. As part of the evaluation of a pediatric patient with hypertension, the 2004 Fourth Report included a recommendation to obtain an echocardiogram, to assess for possible left ventricular hypertrophy (LVH), defined as left ventricular mass index (LVMI) $\geq 51.7 \text{ g/m}^{2.7}$. However, since 2004 several publications have

reported LVH among some prehypertensive pediatric patients,¹¹ and an independent effect of obesity on cardiac mass,¹² and different approaches to quantifying cardiac mass. These developments led to different recommendations in the 2017 CPG for pediatric patients. The 2017 CPG retained the LVH definition of LVMI ≥ 51.7 g/m^{2.7} for children and adolescents over 8 years of age, but states that LVH could also be defined as Left ventricular mass (LVM) >115 g/body surface area in boys and >95 g/body surface area in girls. Additional cardiac parameters of concentric LVH and decreased LV ejection fraction were also defined and added to the 2017 CPG. It is recognized by the 2017 CPG authors that further study is needed to determine the clinical significance of a LVMI >95th percentile (of LVMI normative data) but <51.7 g/m^{2.7}, as well as the most appropriate cardiac mass index.

Another change in the 2017 CPG recommendation is the timing of the echocardiogram. Rather than obtaining an echocardiogram as part of the hypertension evaluation, the 2017 CPG recommends performing an echocardiogram when pharmacological treatment is considered, as it would facilitate decision making on drug therapy. Repeat echocardiogram may also be considered to monitor identified LVH or reduced LV ejection fraction on the initial echocardiogram. A repeat echocardiogram can also be indicated in patients on whom the initial echocardiogram was normal but have secondary hypertension or insufficient BP reduction of secondary hypertension or stage 2 hypertension.

There is strong evidence in support of antihypertensive therapy in adult hypertensive patients for the purpose of primary prevention of subsequent cardiovascular events. Similar evidence in pediatric hypertensive patients is lacking. Therefore, a major emphasis has been, and continues to be, on non-pharmacologic, or lifestyle changes in diet, physical activity, and

weight control. Indications for pharmacologic therapy in pediatric hypertensive patients continue to be conservative in the 2017 CPG and include persistent hypertension despite lifestyle modification especially with an abnormal echocardiogram, stage 2 hypertension without a modifiable risk factor, and any stage of hypertension in patients with diabetes or chronic kidney disease. The 2017 CPG is less specific with recommendations on management of children with persistent hypertension despite lifestyle modification when the echocardiogram is normal. The CPG does advise ongoing BP monitoring every 3 to 6 months with reinforcement of lifestyle changes. When it is clear that lifestyle modification fails to lower BP in a given hypertensive child, pharmacologic therapy is indicated. Other factors to be considered in treatment decisions are the presence of co-morbidities commonly associated with hypertension including dyslipidemia and obstructive sleep apnea. The presence of multiple risk factors can support a move to pharmacologic treatment when there has been an insufficient or no response to lifestyle modification.

Since the 2004 Fourth Report, clinical trial data on safety and efficacy have been obtained in children for newer antihypertensive drugs; and an updated list of recommended drug doses in children is provided in the 2017 CPG. Drug classes that are recommended for initial drug treatment of pediatric patients with primary hypertension include angiotensin converting enzyme inhibitors (ACE-I), angiotensin receptor blockers (ARB), long-acting calcium channel blockers (CCB), or thiazide diuretics. For patients with chronic kidney disease, diabetes, or proteinuria, the 2017 CPG strongly recommends an ACE-I or ARB as the initial drug treatment. Since the 2004 Fourth Report, new data demonstrate that hypertensive TOD can be detected at BP levels <95th percentile, and BP reduction to below the 90th percentile can reverse LVH. Therefore, the treatment goal recommended by the 2017 CPG is systolic and diastolic BP <90th percentile or <130/80 mm Hg, whichever is lower (based on office BP measurements). An

exception to this treatment goal is the BP target for children with chronic kidney disease where there is strong clinical trial data that treatment with an ACE-I to a target of <50th percentile of mean 24-hour ambulatory blood pressure reduces the rate of decline in kidney function.¹³

The 2017 CPG is a large document that was developed according to the strict evidence based approach recommended by the NHLBI. In addition, it is the first pediatric hypertension guideline in which the adolescent age period is largely aligned with the new adult hypertension CPG. A review of the extensive literature related to BP and hypertension in childhood published since 2004 resulted in several modifications of recommendations on management of elevated BP and hypertension in childhood. While the 2017 CPG will provide guidance on achieving optimal BP management throughout childhood, there remain many unanswered questions that require further research. It is expected that acquisition of new evidence in the future will direct subsequent CPG updates and modifications.

Disclosures: None

References:

1. Blumenthal S, Epps RP, Heavenrich R, et al. Report of the task force on blood pressure control in children. *Pediatrics* 1977;59:I-II, 797-820.
2. Falkner B, Daniels S, Flynn JT, Gidding S, et al. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics* 2004;114:555-76.

3. Gibbons GH, Shurin SB, Mensah GA, Lauer MS. Refocusing the agenda on cardiovascular guidelines: an announcement from the National Heart, Lung, and Blood Institute. *Circulation* 2013;128:1713-15.
4. Flynn JT, Kaelber DC, Baker-Smith CM, et al. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics* 2017;140.
5. Institute of Medicine. Committee on Standards for Systematic Review of Comparative Effectiveness Research. Standards for Systematic Reviews. In: Eden J LL, Berg A, Morton S., eds. *Finding What Works in Health Care*. Washington, DC: National Academies Press; 2011.
6. Rosner B, Cook N, Portman R, Daniels S, Falkner B. Determination of blood pressure percentiles in normal-weight children: some methodological issues. *American Journal of Epidemiology* 2008;167:653-66.
7. Hansen ML, Gunn PW, Kaelber DC. Underdiagnosis of hypertension in children and adolescents. *JAMA* 2007;298:874-9.
8. Whelton PK, Carey RM, Aronow WS, et al. ACC/AHA/AAPA/ABX/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guidelines for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults. A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Hypertension* 2017; In press
9. Flynn JT, Daniels SR, Hayman LL, et al. Update: ambulatory blood pressure monitoring in children and adolescents: a scientific statement from the American Heart Association. *Hypertension* 2014;63:1116-35.

10. Siu AL, U.S. Preventive Services Task Force. Screening for high blood pressure in adults: U.S. Preventive Services Task Force recommendation statement. *Annals of Internal Medicine* 2015;163:778-86.
11. Urbina EM, Khoury PT, McCoy C, Daniels SR, Kimball TR, Dolan LM. Cardiac and vascular consequences of pre-hypertension in youth. *Journal of clinical hypertension (Greenwich, Conn)* 2011;13:332-42.
12. Brady TM. The role of obesity in the development of left ventricular hypertrophy among children and adolescents. *Current hypertension reports* 2016;18(1):3.1.
13. Group ET, Wuhl E, Trivelli A, et al. Strict blood-pressure control and progression of renal failure in children. *The New England journal of medicine* 2009;361:1639-50.

Accepted Manuscript