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Abstract

Following the 2016 guidelines for blood pressure measurement, diagnosis and investigation of pediatric hypertension, we now present evidence-based guidelines for the prevention and treatment of hypertension in children. These guidelines were developed by Hypertension Canada’s Guideline Committee pediatric subgroup after thorough evaluation of the available literature. Included are 10 guidelines specifically addressing health behaviour management, indications for drug therapy in children with hypertension, choice of therapy for children with primary hypertension and goals of therapy for children with hypertension. While the pediatric literature is inherently limited by small numbers of participants, fewer trials, and a prolonged latency to the development of vascular outcomes, this manuscript reflects the current and highest level of evidence and provides guidance for primary care practitioners on the management of pediatric hypertension. Studies of therapeutic lifestyle modifications in children are available to guide current management and more antihypertensive drugs have been studied in children since the Food and Drug Administration Modernization Act. Consistent with Hypertension Canada’s guideline policy, diagnostic and therapeutic algorithm tools will be developed and the guidelines will be reviewed annually and updated according to new evidence.

Brief Summary

Hypertension Canada has a long history of developing evidence-based guidelines for prevention, diagnosis, and management of hypertension in adults. In 2016, we published the inaugural Hypertension Canada Pediatric Guidelines for measurement of blood pressure and diagnosis and assessment of hypertension in children. This 2017 update follows with best-evidence guidelines for management of diagnosed hypertension including health behaviour management, indications for drug therapy, choice of therapy, and goals of therapy for children with hypertension.
Introduction

The prevalence of hypertension in children is 1-2% in Canada and is closely associated with childhood obesity and sedentary activity patterns in youth.\(^1\,^2\) Fortunately, there are encouraging data suggesting that the prevalence of obesity is stabilizing and that the prevalence of elevated blood pressure in children is decreasing, especially in overweight or obese adolescents in the United States.\(^3\) These findings underscore the importance of a continued and evidence-based approach toward improving the cardiovascular health of Canadian children.

Health behaviour modification lies at the foundation of hypertension prevention and management in children. The use of pharmacotherapy in hypertensive children has been increasingly studied over the past two decades, and more evidence is currently available to inform therapeutic decision-making in pediatric populations. However, there are important limitations, compromising the quality of this evidence, including: small numbers of participants, short follow-up, the use of surrogate outcomes (i.e. blood pressure change), industry–funding, and absence of traditional placebo control.

In 2016, Hypertension Canada’s Guidelines Committee (GC) published their first pediatric guidelines for blood pressure measurement, diagnosis and investigation of pediatric hypertension.\(^4\) Having provided guidance on identification of hypertension in children, the next crucial step is to provide guidance for management of hypertension. Following the highly structured Hypertension Canada’s guideline process, the pediatric subgroup systematically evaluated existing literature to construct guidelines for the prevention and treatment of pediatric hypertension. Specifically, guidelines were developed for health behaviour management, indications for drug therapy in children with hypertension, choice of therapy for children with primary hypertension, and goals of therapy for children with hypertension.

Together these guidelines aim to guide primary care practitioners and pediatricians to identify, investigate and manage hypertension in children and adolescents while also provide recommendations on when referral to experts in pediatric hypertension is appropriate. Health behaviour modification may be beneficial to hypertensive children of all ages. Medications need to be dosed on a milligram per kilogram basis in children and dosing ranges may differ from adults so familiarity with the drugs is important for treating physicians. Our guidelines for pharmacologic treatment of pediatric hypertension by primary care practitioners apply to children ≥12 years of age with primary hypertension. As is standard practice with Hypertension Canada guidelines, diagnostic and therapeutic algorithm tools will be developed and guidelines will continue to be reviewed annually and updated as new evidence becomes available.

Methods

Hypertension Canada’s GC is a multidisciplinary panel of content and methodological experts comprised of 1 Chair, 1 Chair of the Central Review Committee (CRC), a CRC, and 15 subgroups. Each subgroup addresses a distinct content area (Supplemental Appendix S1 presents the current GC membership list). Members of the Canadian Task Force on Preventive Health Care, the Canadian Diabetes Association Guidelines Committee, the Canadian Society of Nephrology, the Canadian Stroke Network, the Canadian Cardiovascular Society, and the Canadian Cardiovascular Harmonized National Guideline Endeavour Initiative regularly
collaborate with Hypertension Canada members to facilitate harmonization of hypertension-related guidelines across organizations. In many cases, Hypertension Canada GC members serve as volunteers for multiple organizations.

A systematic literature search of Medline/PubMed from January 2004 to December 2015 was performed by a highly trained research librarian. Search terms included hypertension and blood pressure; these were combined with relevant topic-specific terms and age limited to children (birth to 18 years). References of identified articles were also reviewed to identify additional works. Details of search strategies and retrieved articles are available on request.

The pediatric subgroup reviewed the search results. Study characteristics and quality were assessed using pre-specified standardized algorithms developed by Hypertension Canada’s GC for the critical appraisal of studies. Recommendations were graded according to the strength of their underlying evidence (details in Supplemental Table S1) from Grade A (strongest evidence, based on high-quality studies) to Grade D (weakest evidence, based on low-powered imprecise studies or expert opinion). Although Hypertension Canada’s GC does not use the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) recommendation scheme (www.gradeworkinggroup.org), it should be noted that all GC guidelines are considered to be “strong” in nature.

Pediatric subgroup members are hypertension specialists in pediatric nephrology, pediatric cardiology, pharmacology, and nursing. The pediatric subgroup was responsible for reviewing abstracts, critically appraising the literature, and drafting the guidelines. An independent CRC consisting of methodological experts with no industry affiliations independently reviewed, graded, and refined the proposed guidelines, which were then presented at a consensus conference of the GC in Montreal, Quebec, Canada on October 19, 2016. Present at the meeting were the Chair of the Hypertension Canada’s GC, the CRC Chair, the CRC, and members of all subgroups. Further revisions to proposed guidelines were based on these discussions.

Members with potential conflicts of interest recused themselves from voting on specific guidelines (a list of conflicts is available in Supplemental Appendix S2). After the consensus meeting, the guidelines that were supported by the majority of the consensus conference attendees were finalized and submitted electronically to all 81 voting members of the Hypertension Canada GC for final approval. Guidelines receiving > 70% approval passed. The Hypertension Canada guidelines process is in accordance with the AGREE II guidelines and has been externally reviewed. A summary of how the Hypertension Canada guidelines process aligns with AGREE II can be found online at http://guidelines.hypertension.ca/about/overview-process/. Materials to assist with patient and public education based on these guidelines are available at http://www.hypertension.ca.

**The 2017 Hypertension Canada’s Guidelines for Diagnosis and Assessment of Hypertension in Children**

I. **Accurate measurement of blood pressure in children**

**Background**
There are no changes to these guidelines for 2017.

**Guidelines**
1. Blood pressure (BP) should be measured regularly in children 3 years of age and older by a health care professional using standardized pediatric techniques (Supplemental Table S2) (Grade D).
2. BP may be measured with a mercury sphygmomanometer, aneroid sphygmomanometer, or oscillometric device (Grade D). Abnormal oscillometric values should be confirmed with auscultation (Grade C).
3. BP varies with age, sex, and height in children, and BP values should therefore be compared with norms for age, sex, and height (Supplemental Table S3) (Grade D).

II. Criteria for diagnosis of hypertension in children

**Background**
There are no changes to these guidelines for 2017.

**Guidelines**
1. Using office BP measurements, children can be diagnosed as hypertensive if systolic blood pressure (SBP) or diastolic blood pressure (DBP) is ≥ the 95th percentile for age, sex, and height, measured on at least 3 separate occasions (Grade C).
2. If the BP is ≥ the 95th percentile, BP should be staged. Stage 1 is defined by BP between the 95th and 99th percentiles plus 5 mm Hg. Stage 2 is defined by BP > the 99th percentile plus 5 mm Hg (Grade D).
   i. If BP is stage 1, BP measurements should be repeated on 2 more occasions within 1 month; if hypertension is confirmed, evaluation (as described in section IV) or appropriate referral should be initiated within 1 month, or both (Grade D).
   ii. If BP is stage 2, prompt referral should be made for evaluation and therapy (Grade C).
3. All children with suspected or confirmed hypertension should undergo a hypertension-focused history and physical evaluation (Supplemental Table S4) (Grade C).

III. Assessment of overall cardiovascular risk in hypertensive children

**Background**
There are no changes to these guidelines for 2017.

**Guideline**
1. Cardiovascular risk factors should be assessed in hypertensive children (Grade C).

IV. Routine laboratory tests for the investigation of children with hypertension

**Background**
There are no changes to these guidelines for 2017.

**Guidelines**

1. Routine tests that should be performed for the investigation of all children with hypertension include:
   i. Blood chemistry (sodium, potassium, chloride, total CO2, and creatinine) (Grade D)
   ii. Urinalysis (Grade D)
   iii. Renal ultrasonography (Grade D)

2. Routine laboratory tests that should be performed for the assessment of cardiovascular risk in all children with hypertension include the following:
   i. Fasting blood glucose (Grade C)
   ii. Serum total cholesterol and high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, and triglyceride levels (Grade C)

3. Routine tests that should be performed for the assessment of target organ damage in all children with hypertension include the following:
   i. Echocardiography (Grade C);
   ii. Retinal examination (Grade C);
   iii. Albumin-to-creatinine ratio (first-morning determination) (Grade D)

V. **Ambulatory blood pressure monitoring in children**

**Background**

There are no changes to these guidelines for 2017.

**Guidelines**

1. For children with elevated office BP readings, ambulatory blood pressure monitoring (ABPM) should be guided by a physician with expertise in pediatric hypertension; ABPM is useful to classify BP (Supplemental Table S5) (Grade C).

2. Physicians should use only ABPM devices that have been validated independently in children using established protocols. A standard approach to obtaining ABPM readings should be used (Supplemental Table S6) (Grade D).

3. ABPM levels should be interpreted with appropriate pediatric normative data for children ≥5 years of age or height of ≥120 cm (Grade D).

VI. **Role of echocardiography**

**Background**

There are no changes to these guidelines for 2017.

**Guidelines**

1. Routine echocardiographic evaluation in children with confirmed hypertension is recommended (Grade D).
2. The echocardiographic assessment should include measurements of left ventricular mass index (LVMI), systolic and diastolic left ventricular function, and evaluation of the aortic arch (Grade D).

The 2017 Hypertension Canada’s Guidelines for the Prevention and Treatment of Hypertension in Children

I. Health Behaviour Management

Background
In the Canadian Health Measures Survey, the strongest effect on blood pressure in obese children and adolescents was BMI. BMI, calculated by dividing weight in kilograms by the square of height in meters, should be determined for all children at routine health visits. Values need to be compared to pediatric normative curves with a BMI > 85th percentile consistent with overweight and > 97th percentile with obesity in children ≥ 5 years of age based on World Health Organization data. Information and growth charts are available at www.cps.ca/tools-outils/who-growth-charts.

With the reported associations between childhood blood pressure and BMI, diet, and physical activity, recent intervention studies to modify these risk factors have demonstrated some improvements in markers of cardiovascular health. One randomized controlled trial of exercise intervention including 60 minutes of physical activity three times a week for 3 months compared to no intervention showed reduction in office and ambulatory blood pressure in the physical activity group. In the no intervention group, the blood pressures increased so that the exercise intervention blood pressure difference was 7 mmHg for clinic SBP and DBP, and 11 mmHg for 24 hour ambulatory SBP. They also showed improvements in carotid intima-media thickness and arterial stiffness in the intervention group at 6 months. A systematic review and meta-analysis of exercise intervention trials in children with obesity showed a small but significant pooled effect estimate for reduction in blood pressure. The analysis was likely affected by the heterogeneity in trial design with differences in duration of study intervention, frequency of intervention, length of time of activity during session, and total exercise time. These limitations make it challenging to offer specific evidence-based recommendations for amount and frequency of physical activity, and an individualized and patient-centered approach is likely to be the most successful.

Evidence for dietary improvements in reducing blood pressure in children is increasing. Most children consume high amounts of salt and a meta-analysis of 10 controlled trials of salt reduction in children by 42% found a small but significant reduction in both systolic (-1.2 to -2.5 mmHg) and diastolic (-1.3 mmHg) blood pressures. A longitudinal study of young girls followed for 10 years found that a higher intake of potassium (≥ 2400 mg/day) was related to lower blood pressure. Higher potassium foods are generally fruits and vegetables, as well as dairy products. The Dietary Approaches to Stop Hypertension (DASH) diet, which is high in fruits, vegetables, grains, low fat dairy, and low in fat, sugar, and sodium has shown some benefits in both adult and pediatric populations. Specifically, a randomized cross-over trial of
DASH diet vs. usual dietary advice in children with metabolic syndrome found a reduction in the prevalence of elevated blood pressure with the DASH diet.\textsuperscript{15}

The combination of both dietary improvements and increased physical activity seems to amplify the beneficial effects. A systematic review and meta-analysis of 23 studies of obesity prevention programs in children found that combined diet and physical activity interventions led to a significantly greater reduction in both systolic and diastolic blood pressures than either alone.\textsuperscript{16} While healthy eating and physical activity is taught in most school systems, children with hypertension, obesity or those at risk for either may benefit from specific advice from health care practitioners or allied health team members to improve these healthy behaviours. A patient- and family-centered approach to promote changes to the entire family diet and lifestyle may increase the probability of long-term beneficial change.\textsuperscript{17}

Guidelines

1. Height and weight should be measured and body mass index (BMI) calculated for all children at routine health visits (Grade D).
2. Achieving a healthy body weight (BMI percentile <85\textsuperscript{th}) is recommended for non-hypertensive individuals to prevent hypertension and for hypertensive children to reduce blood pressure (Grade C).
3. A comprehensive approach should include dietary education and increased physical activity (Grade C).

II. Indications for Drug Therapy for Children with Hypertension

Background

The decision to initiate drug treatment of pediatric hypertension depends on many factors including the presence of symptoms of hypertension, level of blood pressure elevation, presence of end-organ damage, response to non-pharmacologic therapy, and presence of co-morbid conditions that confer increased cardiovascular risks. Symptoms of hypertension may include irritability, fatigue, dizziness, chest pain, abdominal pain, and headache. End-organ damage may be detected on echocardiogram as left ventricular hypertrophy (LVH), on fundoscopy as hypertensive retinopathy, or on urine analysis as albuminuria. These factors are not entirely exclusive as children with more severe hypertension may also have greater left ventricular mass index (LVMI) and albuminuria than those with less significant hypertension and albuminuria has been correlated with LVMI.\textsuperscript{18,19}

In a retrospective cohort study, Kupferman et al. (2010) compared children treated with antihypertensive medications to untreated patients.\textsuperscript{20} The indications for drug treatment included hypertensive symptoms, severe hypertension, risk factors such as chronic kidney disease, and target organ damage. They found that 33% of treated patients with LVH had resolution of the cardiac anomaly by follow-up echocardiogram after more than 6 months of treatment.\textsuperscript{20} Of untreated patients, 28% developed LVH by follow-up. The change in LVMI correlated with the change in systolic blood pressure.\textsuperscript{20} Additional evidence for pharmacologic intervention comes from the Effect of Strict Blood Pressure Control and ACE Inhibition on the Progression of CRF.
in Pediatric Patients (ESCAPE) trial. They showed that treatment of blood pressure reduced LVMI in all treated and more so in those with LVH.\textsuperscript{21} The prevalence of LVH decreased from 38% to 25% after 1-2 years of treatment. In addition, intensified blood pressure control reduced systolic dysfunction. Many factors, including side effects, need to be considered for initiation of pharmacologic management of hypertension in children but with treatment, cardiac target organ damage can be reduced.

Guidelines

1. Pharmacological therapy should be initiated when patients have:
   a) symptomatic hypertension (Grade D)
   b) hypertensive target organ damage (Grade C)
   c) stage 2 hypertension (Grade D)
   d) blood pressure $\geq$ 90th percentile associated with diabetes mellitus type 1 or 2, chronic kidney disease or heart failure (Grade D)
   e) stage 1 hypertension without target organ damage that persists ($\geq$6 months) despite a trial of non-pharmacologic therapy (Grade D).

2. In children with proven secondary hypertension, specific treatment of the underlying disease must be initiated by an expert in pediatric hypertension (Grade D).

III. Choice of Therapy for Children with Primary Hypertension

Background

There are an increasing number of antihypertensive drugs approved for use in children since passage of the Food and Drug Administration (FDA) Modernization Act in 1997. However, trials have primarily been limited to the newer medications, mostly ACE inhibitors and ARBs. The majority of the drugs are approved for use only in children $>6$ years of age due to limited trials in the younger age groups. In children, medications need to be dosed on a milligram per kilogram basis and dosing ranges may differ from adults due to differences in drug metabolism and body composition.\textsuperscript{22,23} Younger children usually prefer suspension formulations if they are palatable. Targeted drug therapy to an underlying cause of hypertension should be directed by an expert in pediatric hypertension. The younger the child, the more likely they are to have a secondary cause identified for the hypertension. For these reasons, we strongly recommend that the guidelines for pharmacologic treatment of pediatric hypertension by primary care practitioners should apply only to children $\geq12$ years of age. Younger children and those suspected of having a secondary cause for their hypertension should be referred to and managed by experts in pediatric hypertension. The pharmacologic guidelines apply to children with systolic and/or diastolic hypertension.

There are 3 good quality randomized controlled trials of ACE inhibitors in children with hypertension. The drugs studied include enalapril, lisinopril, and fosinopril and each showed a good blood pressure response to the medication (-6 to -16 mmHg) and difference from placebo in the withdrawal phase (4 to 6 mmHg).\textsuperscript{24-26} Meta-analysis of all ACE inhibitor trials in children submitted to the FDA showed that black patients experienced less blood pressure reduction than other races with these drugs.\textsuperscript{27} Side effects are uncommon but are similar to adult patients with
the potential for hypotension, increased serum creatinine, acute kidney injury, hyperkalemia, and angioedema.23,28 Cough seems to be less common in children with ACE inhibitors and not different than placebo in trials.29 Interval monitoring of kidney function and electrolytes should be practiced and caution should be used when considering these drugs in children prone to dehydration. Counselling on risks of teratogenicity should be done in females of child-bearing age.

Several randomized controlled trials of ARBs in children with hypertension have shown a good blood pressure response to the medication (-6 to -13 mmHg) and a difference from placebo (3 to 7.5 mmHg).30-33 Good quality trials been completed with losartan, candesartan, olmesartan, and valsartan. Most of the studies report a lesser blood pressure response in black patients. Side effects are not common and potentially may include hypotension, hyperkalemia, and acute kidney injury.23 Similar to ACE inhibitors, caution should be used with these medications in children prone to dehydration, kidney function and electrolytes should be monitored, and counselling on risks of teratogenicity should be done in females of child-bearing age. One comparison trial randomized hypertensive children to either ARB (valsartan) or ACE inhibitor (enalapril) and found similar significant reductions in blood pressure in both groups.34

β-blockers are less well-studied in children. Only one trial in the literature has been completed using extended release metoprolol demonstrating a blood pressure reduction significantly different from placebo.35 With potential for bronchospasm, β-blockers are not recommended in children with asthma.23 They also cause bradycardia by their mechanism of action, and are therefore not preferred in high performance athletes and β-blockers may mask symptoms of hypoglycemia in children with diabetes mellitus.23 More recent studies in adults suggest an increased risk of insulin resistance and new diabetes onset with β-blockers making them a less desirable choice in children with or at risk for diabetes mellitus.28,36

Other medications studied for pediatric hypertension have had less consistent results. Trials of the long-acting dihydropyridine calcium channel blockers amlodipine and felodipine have shown modest differences from placebo in blood pressure response but the trials were confounded by lack of adjustment for body weight, low drug dosing, and inadequate time during the dose titration phase.37,38 Benefits of calcium channel blockers include good tolerance of the drug with uncommon side effects including edema and gingival hyperplasia, and no need for bloodwork monitoring.28 Only a single trial of a combination antihypertensive drug has been completed in children with a β-blocker/thiazide combination but the blood pressure reduction was not significantly different from placebo.39 Unlike in adult populations, diuretics alone have not been systematically studied in children for hypertension. In practice, diuretics are used in combination with other antihypertensive agents but caution must be taken given the potential for electrolyte disturbances or dehydration with minor illness in children.19-21,23,28 The lack of trials of single pill combination drugs and diuretics limits our ability to provide guidance regarding the efficacy of these medications for the treatment of pediatric hypertension.

A recent Cochrane systematic review of randomized placebo controlled trials of antihypertensive drugs in children found a limited number of positive trials with most trials of very low quality evidence by their strict criteria.40 Simonetti et al. (2007) completed a systematic analysis of data from 27 antihypertensive drug trials in children and found that all drug classes (ACE inhibitors,
ARBs, and calcium channel blockers) reduced blood pressure by a similar amount with a mean of just over 10 mmHg.\textsuperscript{41} Our recommendations are based on the best-available evidence for practitioners who feel comfortable in prescribing antihypertensive medications to children and adolescents. Referral to an expert in pediatric hypertension for blood pressure management is always an acceptable alternative.

**Guidelines**

1. Initial therapy should be monotherapy.
   a. Recommended monotherapy choices are:
      i. an angiotensin converting enzyme (ACE) inhibitor (Grade C),
      ii. an angiotensin receptor blocker (ARB) (Grade C), or
      iii. a long-acting dihydropyridine calcium channel blocker (Grade D).
   b. An alternate option is a beta-blocker (Grade D) although they are less preferable due to the side effect profile in children.
   c. If there are adverse effects, another drug from this group should be substituted.

2. If blood pressure goals are not achieved with standard-dose monotherapy for ≥6 months, children should be referred to an expert in pediatric hypertension (Grade D).

3. ACE inhibitors (Grade C) and ARBs (Grade D) are not recommended as first-line agents in black patients and beta-blockers are not recommended as first-line agents in children with asthma, diabetes (type 1 or type 2) and high performance athletes (Grade D).

**IV. Goals of Therapy for Children with Hypertension**

**Background**

The overall goals of therapy for children with hypertension are to achieve a blood pressure level that reduces the risk of target organ damage in childhood, and ultimately reduces the risk of hypertension and cardiovascular disease in adulthood. The International Childhood Cardiovascular Cohort Consortium has shown that adult carotid intima-media thickness is significantly higher in adults who had elevated blood pressure during childhood that persisted to adulthood compared to those whose blood pressure normalized in adulthood.\textsuperscript{42} In addition, several longitudinal studies provide evidence that elevated blood pressure in childhood increases the risk up to 5 fold for developing adulthood hypertension and metabolic syndrome.\textsuperscript{43-45}

Limited evidence exists assessing goals of pharmacologic treatment of pediatric hypertension to guide hypertension management. In a prospective controlled trial of 12-month antihypertensive treatment of children with hypertension, 80% were able to achieve the goal clinic blood pressure of <95\textsuperscript{th} percentile at 1 year.\textsuperscript{19} With treatment, LVMI decreased by 32% and albuminuria decreased by 45%. A study of pharmacologic treatment of pediatric hypertension to an ABPM goal blood pressure <95\textsuperscript{th} percentile or blood pressure load <25% showed that the prevalence of LVH was lower in those children with controlled hypertension than those with uncontrolled hypertension (13% vs. 46% respectively).\textsuperscript{46} In other ABPM studies, treatment of pediatric hypertension was able to reduce blood pressure to <95\textsuperscript{th} percentile in 53-74% of children, and LVH reduced from 42-46% at baseline to 11-28% at 6-12 months.\textsuperscript{18,47} While these studies show
that targeting a blood pressure < 95th percentile reduces LVH, achievement of the goal does not seem to eliminate the end-organ damage in all. Therefore, it seems reasonable to target < 90th percentile clinic or ambulatory blood pressure in children with current target organ damage or concurrent cardiovascular risk factors including diabetes mellitus type 1 and 2, chronic kidney disease, or a structural or functional cardiac anomaly. This is in keeping with current practice by the majority of pediatric nephrologists in North America. 48

Guidelines

1. The treatment goal is office blood pressure (systolic and diastolic) <95th percentile (Grade D). The goal for ambulatory blood pressure monitoring (ABPM) is blood pressure (systolic and diastolic) <95th percentile (Grade D).
2. For patients with risk factors or target organ damage the goal is blood pressure (systolic and diastolic) <90th percentile (Grade D).

Summary/ Future Directions

These evidence-based guidelines represent the second report of Hypertension Canada’s GC pediatric subgroup. Building on the previous guidelines for blood pressure measurement, diagnosis and investigation of hypertension, the current guidelines on prevention and treatment of pediatric hypertension aim to guide primary care practitioners in providing initial evidence-based care to children and adolescents with hypertension. While the etiology, implications, and management considerations of hypertension in children may differ from adults, we appreciate that primary care practitioners may be evaluating and managing patients of most age groups. We have therefore provided a table that highlights the major guideline recommendations for blood pressure assessment and management from both the pediatric and adult guidelines for comparison (Table 1). Diagnostic and therapeutic algorithm tools to complement the Pediatric Guidelines will be developed by Hypertension Canada’s Implementation Task Force in collaboration with the pediatric subgroup. We will continue to systematically review the literature annually and update guidelines as new evidence emerges.

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Disclosures
A complete list of author disclosures is available in Supplemental Appendix S2.
References


Table 1. Comparison of Hypertension Canada’s 2017 Pediatric and Adult Guidelines for Blood Pressure Measurement and Hypertension Diagnosis, Assessment, and Management

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<th>Pediatric Guidelines</th>
<th>Adult Guidelines</th>
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<tr>
<td><strong>Measurement</strong></td>
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<td>- Use standardized measurement techniques and validated equipment</td>
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<tr>
<td></td>
<td>- Oscillometric device or auscultation method for initial measurement</td>
<td>- Oscillometric devices are preferred over auscultation. Automated office blood</td>
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<td>- Elevated oscillometric values should be confirmed with auscultation</td>
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<td></td>
<td>- BP values should be compared to norms based on age, sex, and height (Table S3)</td>
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<td>- ABPM should be guided by experts in pediatric hypertension</td>
<td>measurements including ABPM (preferable) or home BP monitoring where available</td>
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<td><strong>Diagnosis</strong></td>
<td>- Diagnose by BP percentile based on norms for age, sex, and height and:</td>
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<td>- Dietary education, increased physical activity, alcohol limitation and stress</td>
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<td>- If BP is not controlled with monotherapy, refer to an expert in pediatric hypertension</td>
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<td>- *Initial pharmacologic therapy with either thiazide/thiazide-like diuretic, β-blocker, ACE inhibitor, ARB, or CCB monotherapy or single pill combination with ACE inhibitor + CCB, ARB + CCB, or ACE inhibitor/ARB + diuretic</td>
<td></td>
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</tbody>
</table>

ABPM: ambulatory blood pressure monitoring, ACE: angiotensin converting enzyme, ARB: angiotensin receptor blocker, BP: blood pressure, CCB: calcium channel blocker

* For adults with diastolic with or without systolic hypertension, without compelling indications for specific agents