Cook Children's Health Care System
Clinical Excellence Committee and Blood Pressure Task Force

Evidence based pathway for the diagnosis and management of pediatric hypertension within the primary care setting

Goals:

- Provide criteria for the recognition and diagnosis of pediatric hypertension
- Establish work flows for management of patients with hypertension within the Cook System
- Improve referral patterns of Cook Children's patients with hypertension to specialty care

Inclusion Criteria:

- Patients age 1 to 18 years

Current state: (1)

Data collected and analyzed at Cook Children's retrospectively evaluated appropriate recognition and work up of hypertension (HTN). Selected patients included those between ages of 3 and 18 years of age seen at Cook Children's Nephrology clinic between July 1, 2014 and June 30, 2017. Analysis revealed that 68 % reached criteria for hypertension prior to their referral. Further, after one elevated blood pressure (BP), average time to referral was 3.45 years.

Background: (2, 3, 4, 5, 6, 7)

Survey data reveals the prevalence of HTN in the pediatric population to be approximately 3.5%. High BP readings can be found in 15 – 19% of male and 7 – 12 % of female patients. Additionally, rates are increased in Hispanic, Non-Hispanic African American, and adolescent patients. Pediatricians frequently fail to recognize HTN due to omission of testing and/or failure to evaluate values with known reference charts.

As pediatric obesity rates increase, so increase the rates of pediatric HTN. Risk can begin as early as infancy with elevated BMI in infancy increasing rates of HTN. Additionally, prevalence rates of HTN appear firmly linked to increasing BMI. Elevated BP in adolescence correlates with HTN in young

adulthood. Adolescents with elevated BP progress to HTN at a rate of 7% per year.

Pediatric blood pressure thresholds based on age, gender, and height and expressed in percentile format provide clinicians with the most reliable diagnostic thresholds and form the basis for current hypertension guidelines.

TABLE 1: Definitions for ranges of Hypertension: (5, 6, 7, 8, 9)

	Children ages 1-<13	**Children ≥ 13**
Normal BP	< 90 %	<120/<80
Elevated BP (formerly prehypertension)	≥ 90 to < 95% or 120/80 to < 95%*	Systolic 120 - 129 with diastolic <80
Stage 1 Hypertension	≥ 95% to < 95% plus 12 mm Hg or 130/80 to 139/89*	130/80 to 139/89 mm Hg
Stage 2 Hypertension	≥ 95% + 12 mm Hg or ≥140/90 mm Hg*	≥ 140/90 mm Hg

* Whichever is lower

White coat hypertension is defined as BP of ≥ 95% while in the clinical setting but <95% outside of clinical setting. Ambulatory blood pressure monitoring (ABPM) is required to establish this diagnosis.

Secondary HTN is more common in children with causes including renal disease, coarctation of the aorta, and endocrine disease.
Despite this, the majority of cases of pediatric HTN are primary, or essential, hypertension and have no identifiable etiology.

Causative/Risk Factors: (6, 7, 8, 9)

- Family history of hypertension or congenital renal disease
- Childhood obesity – HTN comorbid in 30%
- History of prematurity <32 weeks GA, very low birth weight less than 1500 grams, or other neonatal condition requiring umbilical artery catheterization
- Sleep disorders with prevalence of 3.6% to 14%.
- Congenital heart disease
- Chronic kidney disease (CKD) with prevalence as high as 50%.
- Recurrent urinary tract disease, hematuria, or proteinuria
- Known renal or urologic disease or malformation
- Endocrine disease including hyperthyroidism, congenital adrenal hyperplasia, and hyperaldosteronism
- Neoplasia including Wilm's tumor, pheochromocytoma, and neuroblastoma
- Solid organ transplant
- Malignancy or bone marrow transplant
- Medications known to increase BP including caffeine, stimulants, cold medications and some illicit drugs
- Other systemic illnesses associated with hypertension, neurofibromatosis, tuberous sclerosis, or sickle cell
- Evidence of elevated intracranial pressure
- Passive exposure to marijuana

Pediatric disease resulting from hypertension: (8)

- Left ventricular hypertrophy
- Retinal injury
- Hypertensive encephalopathy
- Seizures
- Congestive heart failure

Long-term disease risk: (8)

- Increased risk of adult hypertension
- Myocardial infarction
- Stroke
- Renal disease
- Atherosclerosis

Measurement Guidelines: (2, 6, 8, 10)

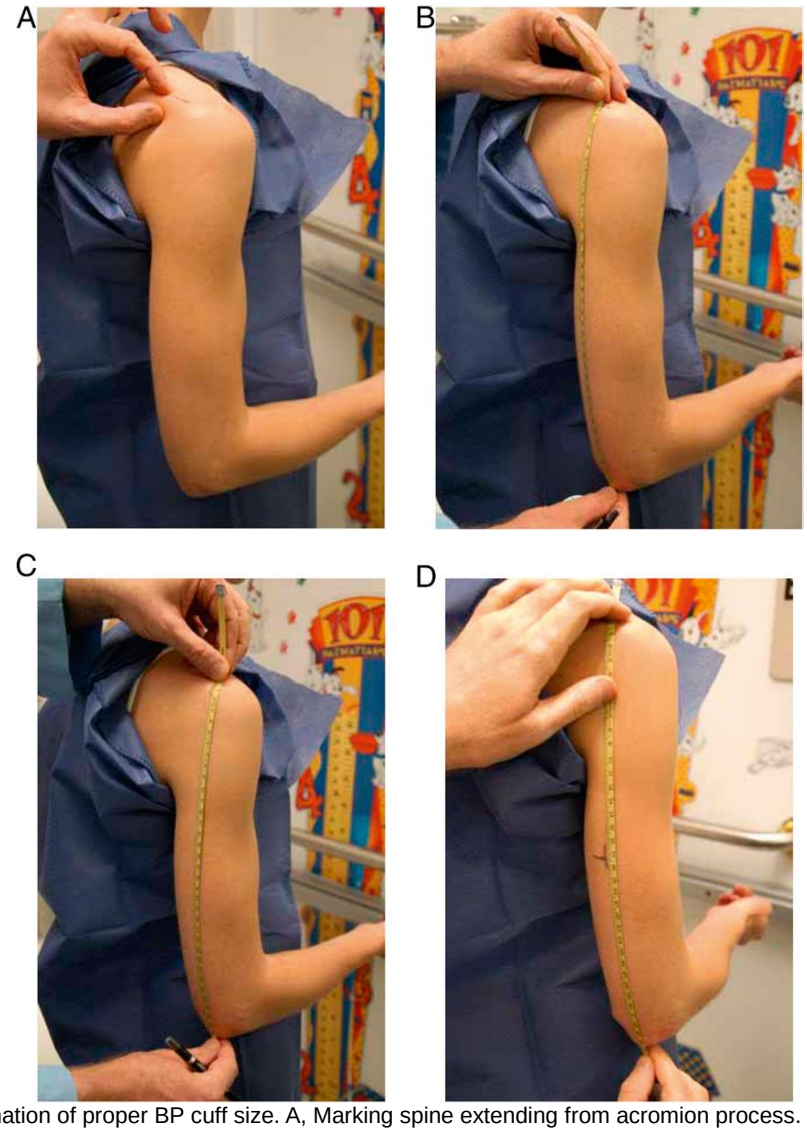
- All healthy children over the age of 3 years of age should have blood pressure measurements with height made annually.
- **All children with underlying health problems or risk factors should have BP measured at every health encounter.** These conditions include: obesity (BMI ≥ 95%), renal disease, aortic arch obstruction or coarctation, diabetes, or current medications known to elevate blood pressure.
- The incidence of hypertension in neonates without underlying risk factors is low with levels estimated between 0.2 and 3%. Based on this information, routine evaluation of BP for healthy infants less than 3 years of age is not recommended.
- Measure BP in children <3 years of age if underlying risk factor which increases risk of elevated BP as outlined on page 3.
- Although oscillometric readings are acceptable, auscultation is preferred for older children as BP tables are based on auscultated measurements
- Automated devices are preferred for newborns and young infants until they are capable of cooperating with auscultation measurement on right arm.
- If automated devices are used and produce a measurement greater than the 90th percentile then confirmation should be made with auscultation.
- Ambulatory blood pressure monitoring should be used for suspected white coat hypertension, for confirmation of clinic measured elevated BP for over 1 year, or for confirmation of stage 1 hypertension on 3 separate clinic visits. Within Cook Children's, ABPM can only be ordered through nephrology.

Positioning of patient:

- Position patient seated comfortably with back supported and feet flat on floor
- Right arm should be supported with antecubital fossa level with heart (right arm preferable to eliminate errors associated with coarctation of aorta)
- Routine measurement of BP should not be done in legs

Choosing the appropriate cuff size:

- The cuff's bladder width should be 40% of the circumference of the mid-arm



Determination of proper BP cuff size. A, Marking spine extending from acromion process. B, Correct tape placement for upper arm length. C, Incorrect tape placement for upper arm length. D, Marking upper arm length midpoint.

- Bladder length should cover 80 to 100% of the circumference of the arm
- Blood pressure measurements will be falsely elevated in a cuff that is too small and falsely low if cuff size is too large

For further details on appropriate BP measurement and training for staff please watch the following video from the American Academy of Pediatrics. (10)
https://www.youtube.com/watch?v=JLzkNBpqwi0&feature=youtu.b

Diagnosis: (8)

- Elevated blood pressure (formerly known as prehypertension) exists when measurements meet criteria defined in Table 1 on 3 consecutive visits.
- Hypertension is established when an average systolic and/or diastolic blood pressure meets criteria as defined on Table 1 on 3 consecutive visits
- Any adolescent ≥ 13 years with a Systolic BP 120 - 129 with diastolic <80 should be considered to have elevated BP and BP ≥130/80 meets hypertension criteria
- White coat hypertension patients exhibit elevated BP over the 95% in clinical settings but are normotensive outside of this setting. Ambulatory blood pressure monitoring is required to establish this diagnosis.

Confirming the Diagnosis (6, 8)

1. BP should be measured appropriately using good positioning of patient and appropriate cuff size.
2. If reading over 90% found during clinical visit, repeat BP twice during same visit after sitting quietly for 5 minutes with back supported and feet flat, preferably via auscultation. Note the initial measurement, and record average of two repeat measurements obtained by auscultation.
3. Elevated BP measurements must be found on 3 consecutive clinical visits to establish the diagnosis of hypertension.

4. If an elevated BP is found in a patient after oral intake of a stimulant or another medication that could affect BP, consider repeating the measurement while the patient is off those medications.

TABLE 2: Follow up Guidelines

	Blood Pressure Percentile	Frequency of BP repeat measurement	Therapeutic Lifestyle Changes	Pharmacologic Therapy	Referral indications
Normal	< 90 %	Annually if no risk factors	None	None	None
Elevated Blood Pressure	≥ 90 to < 95% or 120/80 to < 95%*	Repeat in 6 months and again in 12 months if remains elevated	Weight counseling, dietary modification and physical activity.	None unless significant risk factors as identified on page 3 present	Referral and diagnostic evaluation indicated if readings remain elevated after 12 months
Stage 1 Hypertension	≥ 95% to < 95% + 12 mm Hg or 130/80 to 139/89*	Recheck in 1–2 wks if asymptomatic and again in 3 months if remains elevated	Weight counseling, dietary modification and physical activity.	Initiate therapy if risk factors present or persistent after 3 months	Referral if symptomatic or if BP remains in Stage 1 range after 3 months
Stage 2 Hypertension	≥ 95% + 12 mm Hg or ≥140/90 mm Hg*	Begin further evaluation and referral	Weight counseling, dietary modification and physical activity.	Initiate therapy	Referral should be obtained within 1 week

*Whichever is lower

NOTE: If BP is in the Stage 2 range and the patient is symptomatic or the measurement is > 30 mm HG above the 90% then emergency referral to specialty or ED is indicated.

Evaluating the Pediatric Patient with Confirmed Hypertension: (6, 7, 8, 11, 12)

History: Thorough history focused on potential etiology or contributing factors:

- Nutritional history focusing on salt intake, high-fat foods and sugary drinks
- History of activity level
- Psychosocial history focusing on elements of stress, trauma, bullying, tobacco and alcohol intake
- Renal disease – hematuria, fatigue, edema
- Heart disease – palpitations, chest pain or dyspnea
- Other systems – endocrine or rheumatologic
- Perinatal history – prematurity < 32 weeks GA, very low birth weight less than 1500 grams, or other neonatal condition requiring umbilical artery catheterization
- Past medical history – prior hospitalizations, surgeries, trauma, or snoring
- Family history – hypertension, diabetes, obesity, renal disease, or familial endocrinopathies
- History of environmental exposures including lead, cadmium, mercury, and phthalates
- Medications contributing to hypertension: OTC (such as decongestants, caffeine, NSAIDs, herbal remedies such as ephedra, energy drinks, and athletic-enhancing substances), prescription (such as oral contraceptives or LARCs, ADHD medications/stimulants, and corticosteroids), and illicit (such as amphetamines and cocaine)

Physical:

- At the second visit, if elevated BP is confirmed, 3 extremity BP, 2 arms and 1 leg should be performed.
- To measure BP in the leg, the patient should be placed prone with the cuff placed mid-thigh. If auscultation method used, place the stethoscope over the popliteal artery.
- Systolic BP in legs typically runs 10-20% higher than in arms.

- Identify physical findings indicative of underlying pathology (Appendix B)

Preliminary work up on all children with BP > 90% on consecutive visits or ≥ 95%

- CBC, BUN, creatinine, serum electrolytes
- Urinalysis looking for hematuria and/or proteinuria
- Renal ultrasound if patient less than 6 years, abnormal urinalysis or abnormal renal function studies

Evaluation for suspected co-morbidities:

- Fasting lipid panel
- Uric acid
- Hepatic Panel
- Drug screen
- A sleep history should be taken if child is overweight to screen for obstructive sleep apnea due to strong clinical correlation. Utilization of the BEARS sleep screening assessment (see Appendix A)
- Hemoglobin A1C for patients with BMI over 95% or if family history of type 2 diabetes

Further imaging/evaluation as clinically indicated:

- Echocardiogram on all patients with BP >95% and other individuals with comorbid risk factors at time of institution of pharmacologic treatment for hypertension
- Eye exam for BP over 99% including dilated exam
- Plasma renin for neonatal hypertension or known renal risk factors
- Additional renovascular imaging in children with markedly elevated BP, history of catheterization of umbilical cord, neurofibromatosis or normal weight children ≥ 8 years of age

Management of the Hypertensive Pediatric Patient

Therapeutic Lifestyle Changes: (6, 8, 11 13, 14, 15, 16)

- Weight management
- Increased physical activity to include vigorous physical activity 3-5 days per week for 30-60 minute sessions
- Dietary interventions – educate on **DASH DIET** (**Dietary Approaches to Stop Hypertension**) with focus on fruits, vegetables, whole grains and limit of salt intake to < 2300 mg per day. See Appendix C for more detail
- Family based plan
- Nutrition and/or weight management referral should be considered as appropriate
- Follow up of patients pursuing lifestyle changes only for elevated BP every 3-6 months

Recommendations for Sports Participation (6, 17, 18)

Based on potential benefits found from sports activities, participation in competitive sports should only be limited in two cases as follows:

1. Patients with stage 2 hypertension with/without signs of end organ damage should be limited from participation in sports with a highly static component. Static sports include activities resulting in large intramuscular force with relatively little shortening of the muscle mass or change in joint position. Examples of such would include weight lifting, gymnastics, boxing, wrestling or cycling.

   Limitations should remain in place until BP is normalized with therapeutic lifestyle changes or drug therapy.

2. Athletes with evidence of left ventricular hypertrophy should be limited from sports until BP is normalized.

Athletes with significant hypertension in the 95 to 98 % range for age, height and weight, with no target organ damage or cardiovascular disease

should be allowed to continue with athletic participation while maintaining routine follow up of BP every 2 months with their provider.

Pharmacologic Therapy for Pediatric Hypertension (8)

Indications for treatment:

- Symptomatic hypertension including symptoms of headache, vision changes, chest pain, or abdominal pain
- Stage 1 hypertension resistant to therapeutic lifestyle changes after 3 months
- Additive cardiovascular risk factors such as hyperlipidemia or tobacco use
- Clinical evidence of target organ damage and secondary hypertension
- Highly symptomatic hypertensive emergencies require Urgent ER referral and treatment under specialty supervision
- Any stage of elevated BP with underlying kidney disease

Goals of treatment:

- For patients with uncomplicated primary hypertension and no evidence of target organ disease, decrease systolic and diastolic BP to < 90% or < 130/80 for adolescents ≥ 13 years old.
- Patients with Chronic Kidney Disease (CKD) and HTN should be treated to lower 24-hour MAP to <50th percentile by ABPM.
- For patients with diabetes or visible end-organ disease, decrease BP to < 90% for children 1-12 years old and < 120/80 for children ≥ 13 years old.

Treatment should begin with monotherapy: (6, 8)

First line choices as recommended by Cook Nephrology include:

	Medications	Dosage	Comments	Side Effects
ACE Inhibitor	Lisinopril	Begin 0.07 mg/kg per day to max 5 mg QD	Contraindicated in pregnancy but ideal for male patients	Periodic electrolyte panel to watch for hyperkalemia and azotemia *
Calcium channel blockers	Amlodipine	Children ≥6 years and Adolescents: Initial: 2.5 mg once daily; titrate based on clinical response; maximum daily dose: 10 mg/**day**	Good first choice for female patients	Lower extremity edema, GI intolerance, swollen gums

*Check electrolytes 2-4 weeks after starting medication, after dosage adjustments and annually while on chronic therapy.

Other treatment options include:

- Alternative ACE inhibitors
- Angiotensin-receptor blockers
- β-blockers
- Alternative calcium channel blockers
- Diuretics

Treatment tips:

- Beta-blockers and calcium channel blockers preferred in patients with migraines
- ACE inhibitors preferred in children with IDDM
- Once therapy initiated follow-up should visits occur every 2-4 weeks until goal BP reached and then every 3-4 months

Note: After consultation with Cook Children's specialists, referrals should be made to Cook Children's Nephrology unless cardiac disease found or suspected.

Referral to specialty should be made when:

1. **If BP is in the Stage 2 range and the patient is symptomatic or the measurement is > 30 mm HG above the 90% then emergency referral to specialty or ED is indicated. Referral to BP charts within reference 6 can be made to determine if this range is present.**
2. For clinically confirmed elevated BP, referral indicated for failure to improve after 12 months of therapeutic lifestyle changes.
3. With Stage 1 Hypertension, referral indicated if the patient continues to have elevated BP readings and fails to improve after 3 months of therapeutic lifestyle changes.
4. With stage 2 Hypertension, referral indicated within 1 week of confirmation of elevated BP.
5. Referral indicated for failure to improve with monotherapy as initiated by PCP.
6. If ABPM is needed to confirm White Coat Hypertension, referral to Nephrology must be completed.
7. Parent or PCP requests specialty evaluation.

RESOURCES

Patient handouts and referral resources:

Dash Diet Overview printable pdf from NIH for Families

Why the Dash Diet works?

Fitness resources as recommended by Cook Children's

Kid approved healthy recipes

Nutrition referral sources:

- Cook Nephrology Nutritionist Amanda Marroquin
- Outpatient Nutrition Referral form
- Cook Nutrition Services, call 682-885-4046 or email nutrition.opservices@cookchildrens.org.

Appendix A: BEARS Sleep Screening algorithm (12)

The 'BEARS' instrument is divided into five major sleep domains, providing a comprehensive screen for the major sleep disorders affecting children in the 2 to 18 years old range.

Each sleep domain has a set of age-appropriate 'trigger questions' for use in the clinical interview.
B = bedtime problems
E = excessive daytime sleepiness
A = awakenings during the night
R = regularity and duration of sleep
S = Snoring

Examples of developmental^ appropriate trigger questions

	Toddler/preschool (2-5 years)	School-aged (6- 12 years)	Adolescent (13-18 years)
1. Bedtime problems	Does your child have any problems going to bed? Falling asleep	Does your child have any problems at bedtime? (P) Do you have any problems going to bed? (C)	Do you have any problems falling asleep at bedtime? (C)
2. Excessive daytime sleepiness	Does your child seem overtired or sleep a lot during the day? Does she still take naps?	Does your child have difficulty waking in the morning, seem sleepy during the day or take naps? (P) Do you feel tired a lot? (C)	Do you feel sleepy a lot during the day? In school? While driving? (C)
3. Awakenings during the night	Does your child wake up a lot at night?	Does your child seem to wake up a lot at night? Any sleepwalking or nightmares? (P) Do you wake up a lot at night? Have trouble getting back to sleep? (C)	Do you wake up a lot at night? Have trouble getting back to sleep? (C)
4. Regularity and duration of sleep	Does your child have a regular bedtime and wake time? What are they	What time does your child go to bed and get up on school days? Weekends? Do you think he/she is getting enough sleep (P)	What time do you usually go to bed on school nights? Weekends? How much sleep do you usually get? (C)
5. Snoring	Does your child snore a lot or have difficulty breathing at night?	Does your child have loud or nightly snoring or any breathing difficulties	Does your teenager snore loudly or nightly(P)

(P) Parent-directed question (C) Child-directed question
Mindell Jodi A, Owens Judith A, A Clinical Guide to Pediatric Sleep (Diagnosis and Management of Sleep Problems), Lippincott Williams & Wilkins 2003

Appendix B: Physical Exam Findings suggestive of Underlying Disease (13)

	Physical Exam Finding	Possible disease etiology
Vital Signs	Tachycardia	Hyperthyroidism, pheocromocytoma, neuroblastoma, primary hypertension
	Decreased lower extremities pulses with right arm BP that is 20 mm Hg (or more)greater than the lower extremity BP.	Coarctation of the Aorta
ENT Exam	Adeno-tonsillar hypertrophy	Associated sleep-disordered breathing, snoring
Height/Weight abnormalities	Growth retardation	Chronic renal failure
	Obesity	Primary hypertension
	Truncal obesity	Cushing syndrome, metabolic syndrome
Head and neck	Moon facies	Cushing syndrome
	Elfin facies	Williams syndrome
	Webbed neck	Turner syndrome
	Thyromegaly	Hyperthyroidism
Skin	Pallor, flushing, diaphoresis	Pheochromocytoma
	Acne, hirsutism, striae	Cushing, Anabolic steroid abuse
	Café-au-lait spots	Neurofibromatosis
	Adenoma sebaceum	Tuberous sclerosis
	Malar rash	Systemic lupus erythematosus
	Acanthosis nigricans	Type 2 diabetes
Chest	Wide spaced nipples	Turner syndrome
	Heart murmur	Coarctation of aorta
	Friction rub	SLE (pericarditis), collagen vascular disease, end stage renal disease with uremia
	Apical heave	LVH due to chronic hypertension
Abdomen	Mass	Wilms tumor, neuroblastoma, pheochromocytoma
	Epigastric/flank bruit	Renal artery stenosis
	Palpable kidneys	Polycystic kidneys, hydronephrosis, multicystic dysplastic kidney, mass
Genitalia	Ambiguous/virilization	Adrenal hyperplasia
Extremities	Joint swelling	SLE, collagen vascular disease
	Muscle weakness	Hyperaldosteronism, Liddle syndrome

Adapted from Flynn JT. *Prog Pediatr Cardiol.* 2001;12:177–188.

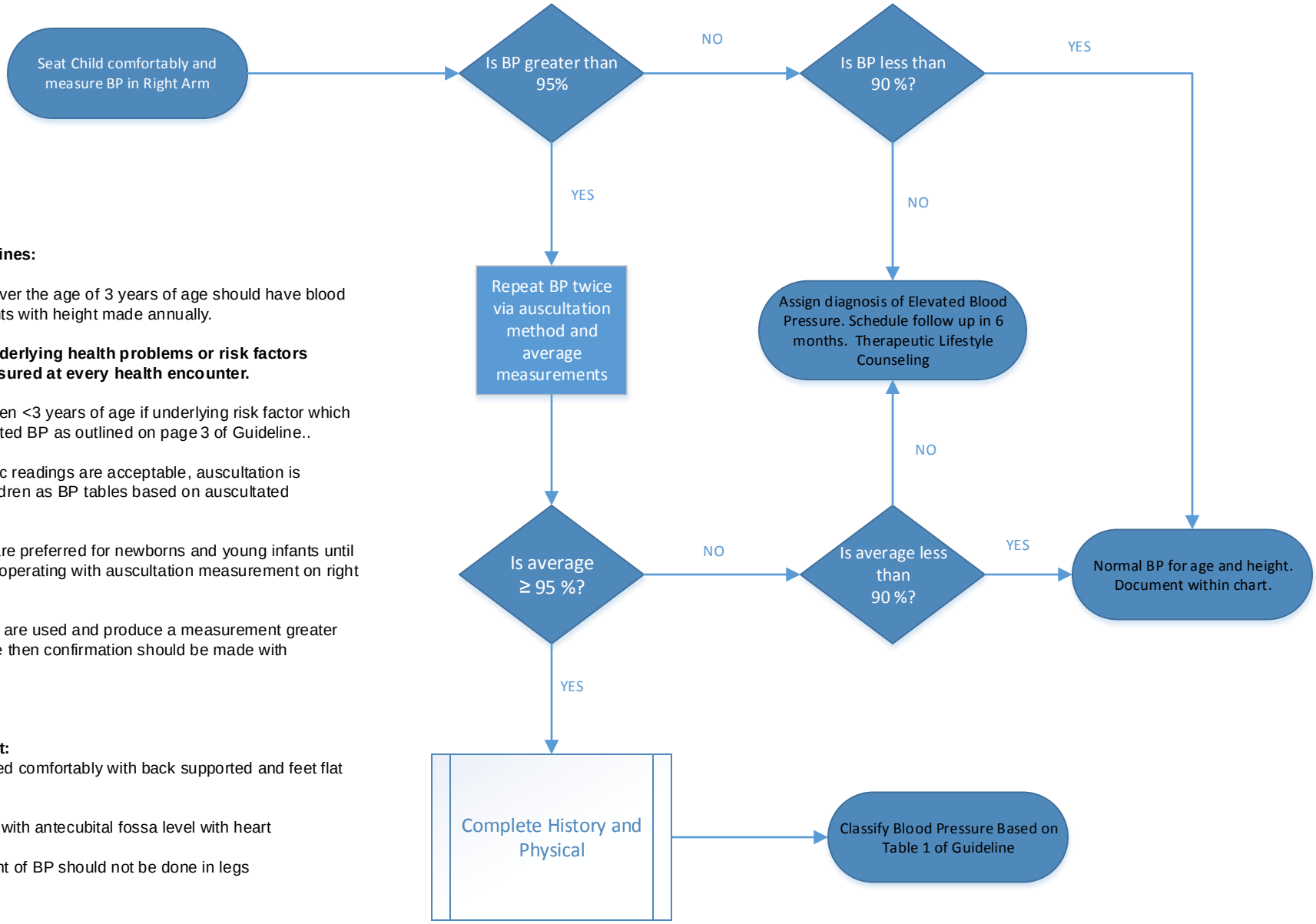
Appendix C: DASH Diet (14,15,16)

Dash Diet Recommendations

Food	Servings per day
Fruits and Vegetables	4-5
Low-fat milk products	≥ 2
Whole grains	6
Fish, poultry, and lean red meats	≤ 2
Legumes and nuts	1
Oils and fats	2-3
Added sugar and sweet (including beverages)	≤ 1
Dietary sodium	< 2300 mg per day

Adapted from Barnes TL, Crandell JL, Bell RA, Mayer-Davis EJ, Dabelea D, Liese AD. Change in DASH diet score and cardiovascular risk factors in youth with type 1 and type 2 diabetes mellitus: the SEARCH for Diabetes in Youth study. *Nutr Diabetes*. 2013;3:e91; US Department of Health and Human Services, US Department of Agriculture. Appendix 7. Nutritional goals for age-sex groups based on dietary reference intakes and dietary guidelines recommendations. In: *2015–2020 Dietary Guidelines for Americans*. Washington, DC: US Department of Health and Human Services, US Department of Agriculture; 2015; and Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents; National Heart, Lung, and Blood Institute. Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents: Summary Report. *Pediatrics*. 2011;128 (suppl 5): S213-S256.

Blood Pressure Measurement Algorithm Children 1-12



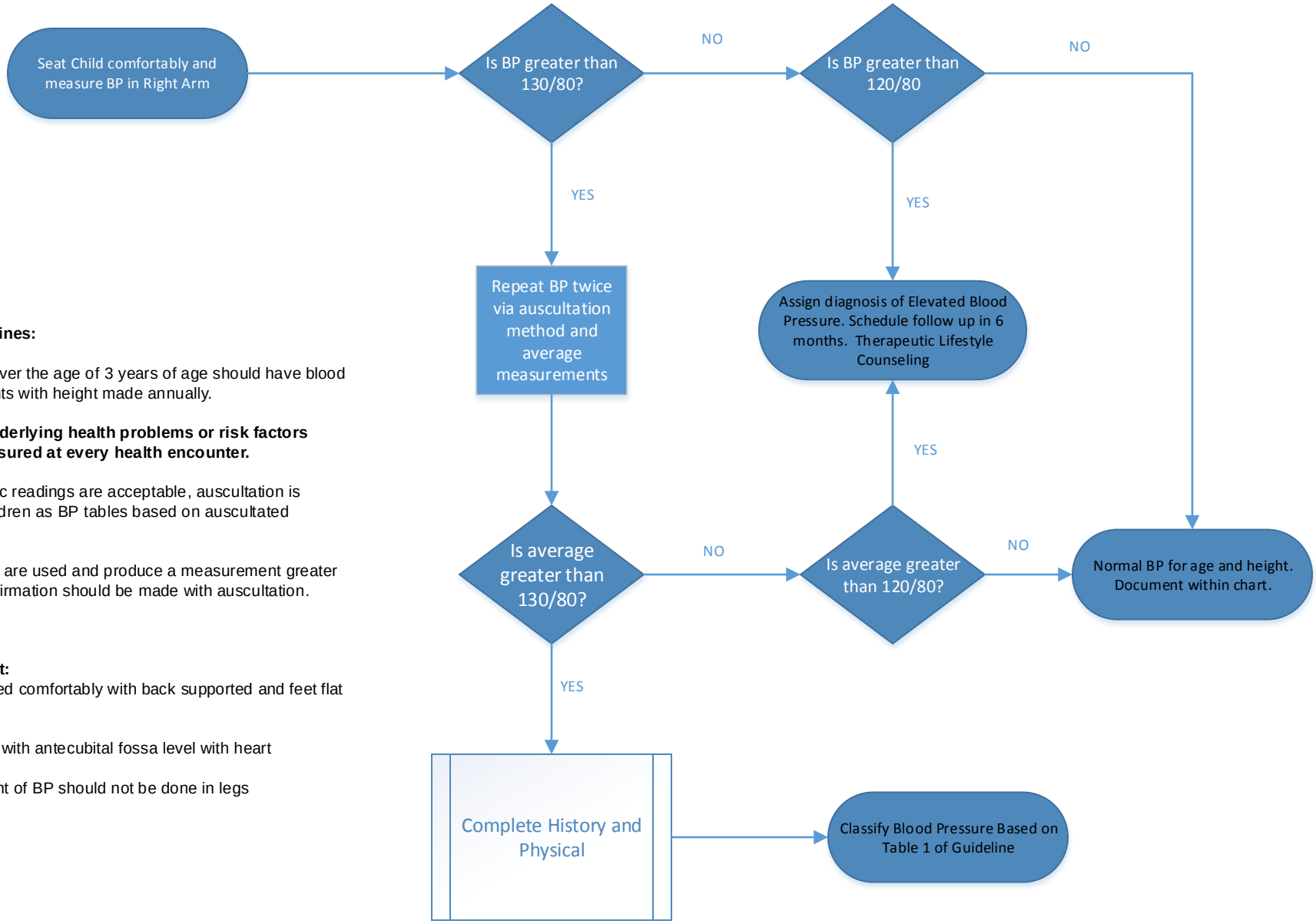
Measurement Guidelines:

- All healthy children over the age of 3 years of age should have blood pressure measurements with height made annually.
- **All children with underlying health problems or risk factors should have BP measured at every health encounter.**
- Measure BP in children <3 years of age if underlying risk factor which increases risk of elevated BP as outlined on page 3 of Guideline..
- Although oscillometric readings are acceptable, auscultation is preferred for older children as BP tables based on auscultated measurements
- Automated devices are preferred for newborns and young infants until they are capable of cooperating with auscultation measurement on right arm.
- If automated devices are used and produce a measurement greater than the 90th percentile then confirmation should be made with auscultation.

Positioning of patient:

- Position patient seated comfortably with back supported and feet flat on floor
- Right arm supported with antecubital fossa level with heart
- Routine measurement of BP should not be done in legs

Blood Pressure Measurement Algorithm Children over 13



Measurement Guidelines:

- All healthy children over the age of 3 years of age should have blood pressure measurements with height made annually.

- **All children with underlying health problems or risk factors should have BP measured at every health encounter.**

- Although oscillometric readings are acceptable, auscultation is preferred for older children as BP tables based on auscultated measurements

- If automated devices are used and produce a measurement greater than 120/80 then confirmation should be made with auscultation.

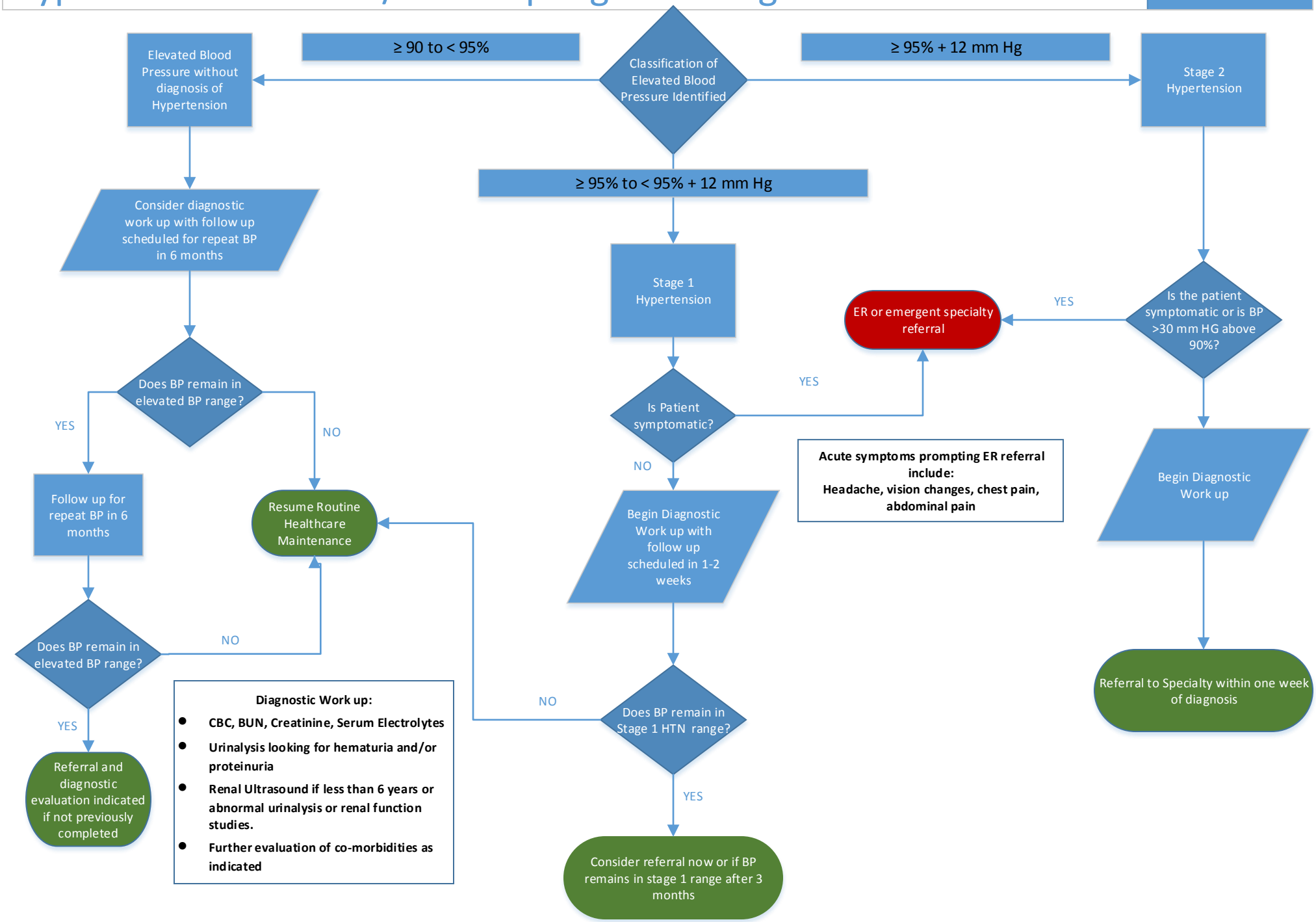
Positioning of patient:

- Position patient seated comfortably with back supported and feet flat on floor

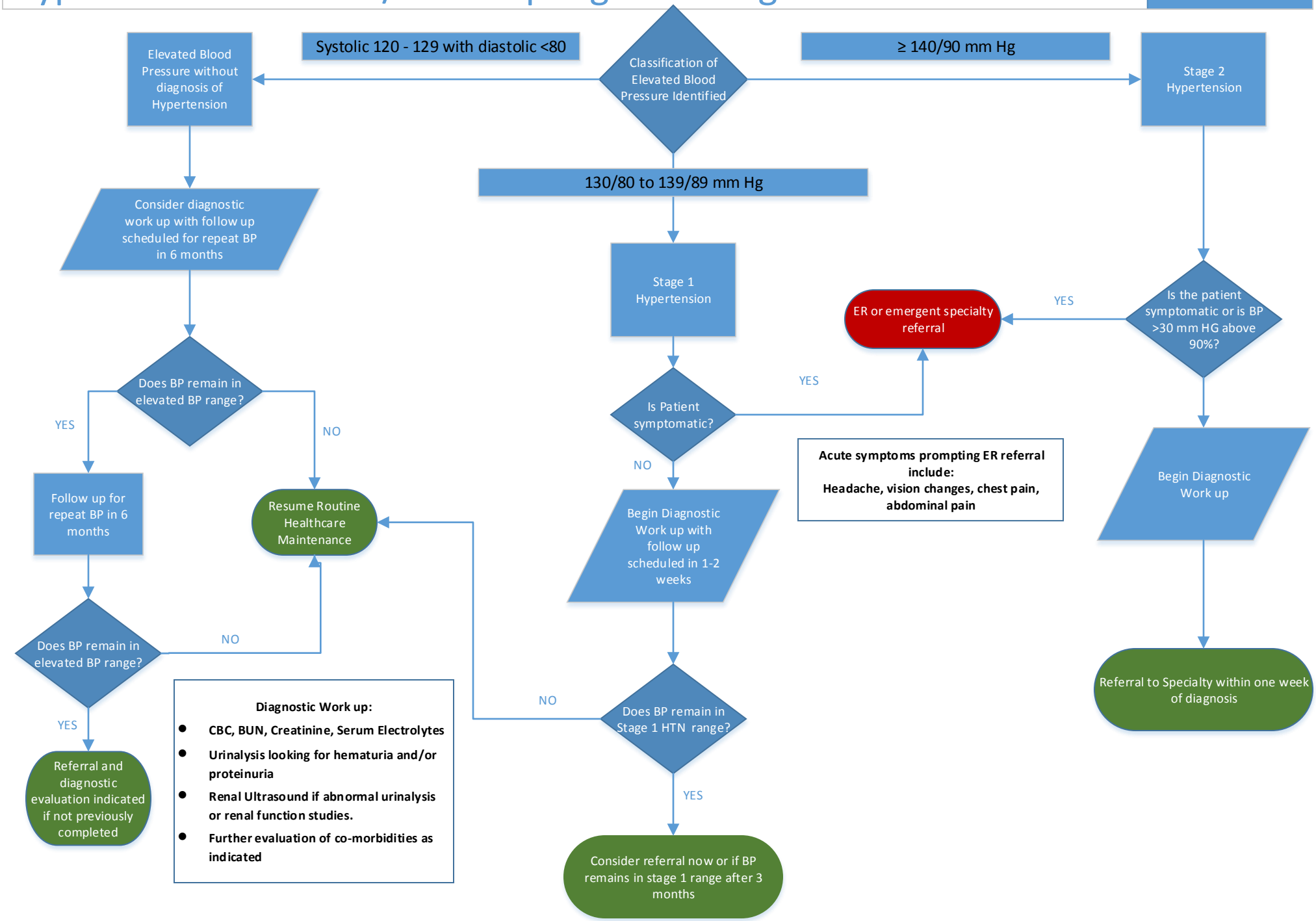
- Right arm supported with antecubital fossa level with heart

- Routine measurement of BP should not be done in legs

Hypertension Referral/Work-up Algorithm Ages 1-12



Hypertension Referral/Work-up Algorithm Ages ≥ 13



References

1. Hamby, T., Pueringer, M., Noorani, S., Barrow, J., & Razzouk, R. (n.d.). Time to referral to a nephrology clinic for pediatric hypertension. *Peditatric Nephrology*.

2. Banker, A., Bell, C., Gupta-Malhotra, M., & Samuels, J. (2016). Blood Pressure percentile charts to identify high or low blood pressure in children. *BMC Pediatrics*.

3. Ricke, T. L., Hendry, P. L., Kalynych, C., Buazianu, E. M., Kumar, V., & Redfield, C. (2011). Incidence and recognition of elevated triage blood pressure in the pediatric emergency department. *Pediatric Emergency Care*, *27*(10), 922-927.

4. Bijlsma, M., MD, Blufpand, H., MD, Kaspers, G., MD, PhD, & Bokenkamp, A., MD, PhD. (2014). Why Peditricians Fail to Diagnose Hypertension: A Multicenter Survey. *The Journal of Pediatrics*, *164*(1).

5. Hansen, M., MD, Gunn, P., BS, & Kaelber, D., MD, PhD. (2007). Underdiagnosis of hypertension in children and adolescents. *JAMA*, *298*(8), 874-879.

6. Flynn, J. T., Kaelber, D. C., Baker-Smith, C. M., & et al. (2017). Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics*, *140*(3).

7. Dionne, J., Abitbol, C., & Flynn, J. (2010). Hypertension in infancy: Diagnosis, management and outcom. *Pediatric Nephrology*, *27*(1), 17-32.

8. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. (2004). The fourth report on the diagnosis,

evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics*, *114*(Supplement 2), 555-576.

9. Majoo, T. (2020). Evaluation and diagnosis of hypertension in infants between one month and one year of age. *Up to Date*.

10. American Academy of Pediatrics (Producer). (2016). *Blood Pressure Measurement in Children* [Film]. EQUIPP.

11. Task Force on Blood Pressure Control in Children. (1987). Report of the Second Task Force on Blood Pressure Control in Children - 1987. *Pediatrics*, *79*(1).

12. Mindell, J. A., & Owens, J. A. (2003). *A Clinical Guide to Pediatric Sleep: Diagnosis and Management of Sleep Problems*.

13. Flynn, J. T. (2001). Evaluation and management of hypertension in children. *Progress in Pediatric Cardiology*, *12*, 177-188.

14. Barnes, T. L., Crandell, J. L., Bell, R. A., Meayer-Davis, E. J., Dabelea, D., & Leise, A. D. (2013). Change in DASH diet score and cardiovascular risk factors in youth with type 1 and type 2 diabetes mellitus: The SEARCH for Diabetes in Youth Study. *Nutrition and Diabetes*, *3*.

15. *Appendix 7.* (US Department of Health and Human Sevices & US Department of Agriculture, Comps.). (2015). https://health.gov/our-work/food-nutrition/2015-2020-dietary-guidelines/guidelines/appendix-7/

16. Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and. (2011). National Heart, Lung, and Blood Institute. Expert Panel on

Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents: Summary Report. *Pediatrics*, *128*(Supplement 5), S213-S256.

17. American Academy of Pediatrics, & Committee on Sports Medicine and Fitness. (1997). Athletic participation by children and adolescents who have systemic hypertension. *Pediatrics*, *99*(4), 637-638.

18. Mitchell, J., Haskell, W., & Raven, P. (1995). Classification of sports. *Journal of the American College of Cardiology*, *24*(4), 864-866.

This guideline is intended to assist providers in decision making by providing the current state of evidence and recommendations. This guideline is not meant to replace clinical judgement and will not be appropriate for all cases.

Hypertension Clinical Guideline Team:
Alice Phillips, MD (Leader) – Primary Care
Matthew Carroll, MD – Hospitalist
Randa Razzouk, MD – Nephrology
Deborah Schutte, MD – Medical Director Cardiology

A special thanks to Dr. Daphne Shaw, Dr. Michael Deitchman, and Dr. Heather Miller for their willingness to provide assistance with the guideline development.

Approved by Clinical Excellence Committee: October 2020
Due for review by Clinical Excellence Committee on or before: October 2023