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Pediatric Hypertension: Early Risk, Detection, and Long-Term Cardiovascular Impact

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CME Disclosure

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Sarah Henson, MD reports the following relevant financial relationships with ineligible companies:

- **AstraZeneca** — Consultant
- **Esperion Therapeutics** — Clinical trial investigator

All relevant financial relationships have been reviewed and mitigated in accordance with AAP CME policies.

Learning Objectives

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By the end of this session, participants will be able to:

1. **Apply current pediatric hypertension (HTN) guidelines** to classify blood pressure and identify abnormal readings in children and adolescents.
2. **Evaluate elevated blood pressure (BP) in children**, including appropriate follow-up, initial workup, and use of ambulatory blood pressure monitoring.
3. **Recognize the long-term cardiovascular (CV) implications of elevated BP in youth** and the role of early lifestyle intervention.

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Why Care About CV Disease?

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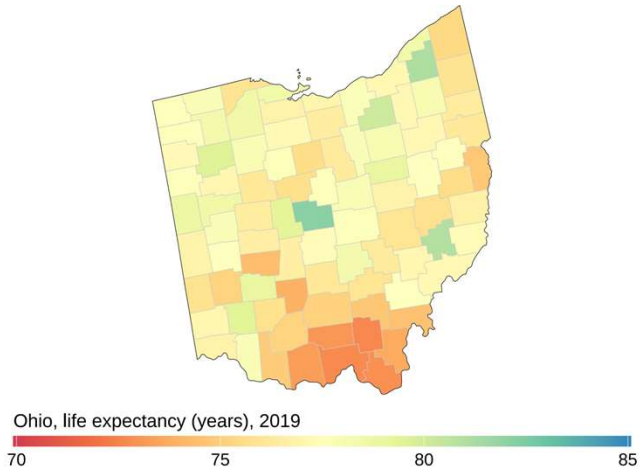
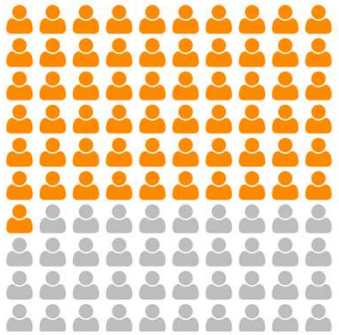
Leading risk factors 2021 ranking

1	Overweight and obesity[5]
2	High blood sugar
3	Smoking
4	Drug use
5	High blood pressure





By 2050, IHME projects that **61%** of young people ages 15 to 24 will be overweight or obese in Ohio.

- Global Burden of Disease Study (GBD) is a global research program of disease burden that assesses mortality and disability from major diseases and risk factors (1990- present)
- CV disease burden from modifiable risk factors continues to increase globally

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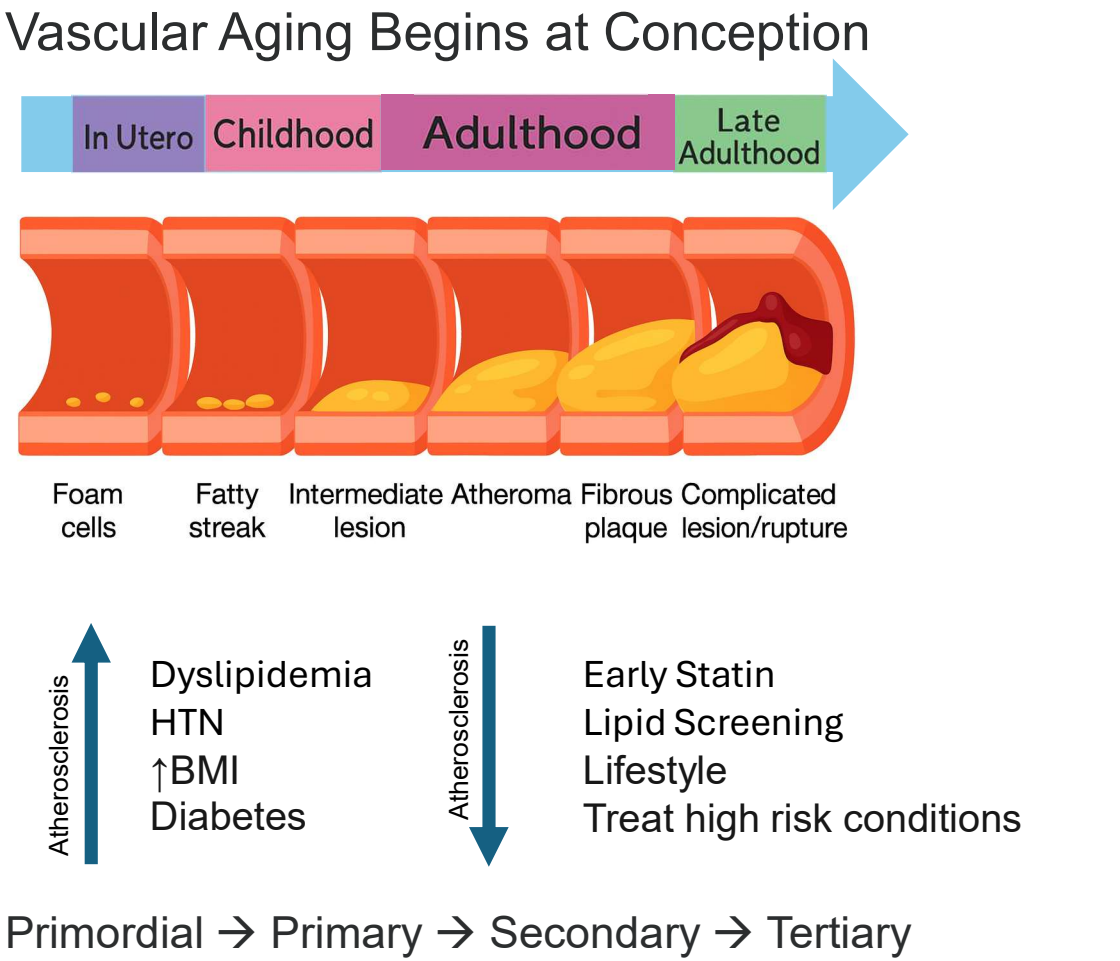
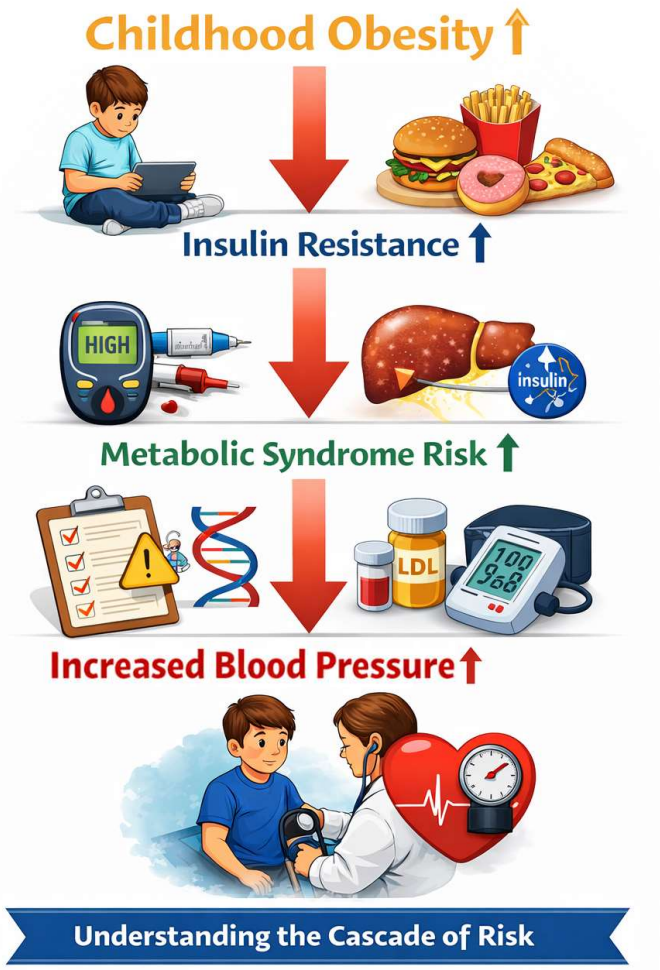
Why It Matters

- Pediatric HTN ~3–5% of children and adolescents
  - Higher in youth with overweight/obesity
  - Prevalence rises in adolescence
  - Often asymptomatic and underrecognized
- Atherosclerosis begins in childhood
  - Accelerated by risk factors
- Early detection/intervention → lower long-term CV risk



Adapted from Pepine CJ. *Am J Cardiol.* 1998; 82(suppl.10A):23S-27S.



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Non-Modifiable Risk Factors:

- Age
- Sex
- Genetics
- Family

More children are entering adulthood with cardiometabolic risk.

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Modifiable Risk Factors in Children

Health Behaviors

Poor Diet

Average Score: **28.5 / 100** in Adolescents

Physical Inactivity

Only **1 in 5** Youth Get ≥**60** Min of Exercise Daily

Inadequate Sleep

Linked to Hypertension, Obesity & Inactivity

Nicotine Exposure

1 in 4 High School Students Report Ever Using Tobacco Products

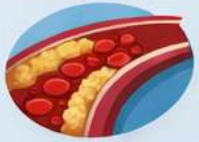
Health Factors

Obesity

15 Million Kids Ages **5-14** Overweight/Obese in the US

High Blood Pressure

Childhood Hypertension Predicts Adult Disease



High Cholesterol

Dyslipidemia & Early Atherosclerosis Risk

Prediabetes

~32.7% of Adolescents Have Prediabetes

Early Detection Matters

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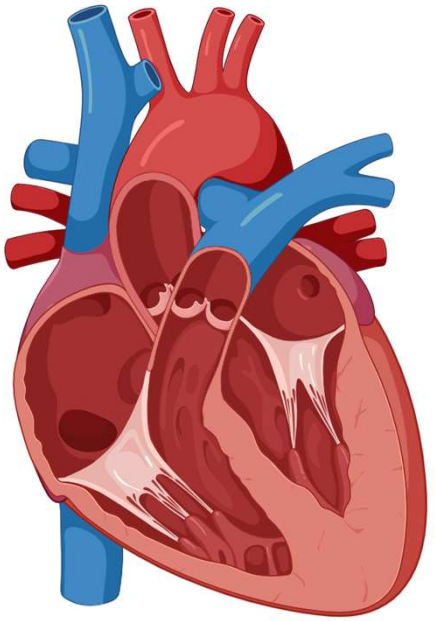
Pediatric HTN causes:
Target Organ Damage (TOD)

- **LVH in ~20–40%** of hypertensive youth
- Increased **arterial stiffness**
- Early vascular remodeling

Bottom line

Early identification allows **prevention of** lifelong CV **disease.**



Left Ventricular Hypertrophy (LVH)

Childhood BP Predicts Adult Risk

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Across cohorts, childhood BP predicts adult HTN, vascular aging, and ASCVD.

Muscatine

- BP tracks to adulthood
- Screening identifies future risk

Bogalusa Heart

- Risks linked to early artery changes

Young Finns

- Risk reduction slows arterial aging

PDAY

- ↑ risk burden → ↑ advanced lesions

CDAH

- BMI/BP trajectories predict adult:
  - HTN
  - Vascular stiffness

i3C Consortium

- Childhood BP predicts ASCVD events

Elevated BP in youth is an **early** cardiovascular **risk signal**, not a benign phase.

Childhood BP Predicts Adult CV Events

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Childhood Risk Factor	Adult CV Outcomes
Normal BP	Baseline risk
High-normal / Elevated BP	**~50% higher risk** CV events
Hypertension	**~2× higher risk** CV events

Hard CV outcomes
- Coronary heart disease
- Stroke
- Heart failure
- CV death

Subclinical CV changes
- LVH
- Increased carotid intima-media thickness
- Arterial stiffness

Even "high-normal" BP in youth increases lifetime CV risk.

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Risk Factor Screening

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Screening	U.S. Guideline Recommendation	Reality in Practice
BP	**Annual BP beginning at age 3 (AAP)**	**~30–50% measured correctly**
ABPM	**Required to confirm HTN diagnosis**	**Limited availability**
BMI	Height/weight BMI %ile yearly	50–70% documented
Glu / A1c	Screen overweight/obese with risk	10–30% screened
Sleep	Sleep duration/OSA symptoms	Rarely assessed
Lipids	Universal screening 9–11 y, 17–21 y	<20% screened

Who & How: Getting BP Right in Kids

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Annually **≥3 yr**

No caffeine/exercise/food
30 mins before

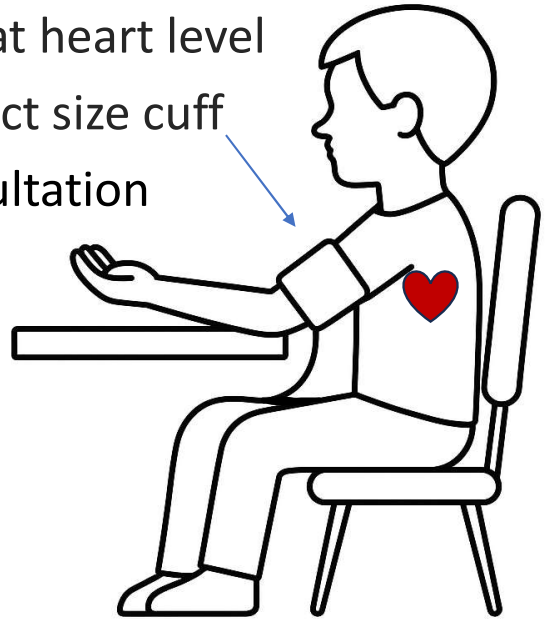
Sit quietly 3-5 min,
back supported & feet flat

Comfortable
temperature

Arm at heart level

Correct size cuff

Auscultation



Inflate 20-30mmHg > radial pulse loss
Deflate 2-3mmHg/sec.
Average 2-3 readings if high.

Definitions

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BP Category	Action	Repeat BP**
Elevated BP	Lifestyle counseling	6 months
Persistent Elevated BP	Reinforce lifestyle	6 months; consider evaluation
Stage 1 HTN	Confirm*	1–2 weeks
Persistent Stage 1 HTN	Evaluate ± ABPM	3 months
Stage 2 HTN	Confirm* Symptoms?	1 week Evaluate/refer

*Confirm oscillometric readings with auscultation.
**Obtain upper and lower extremity BP when HTN is suspected.

Initial Evaluation in Primary Care

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Persistent Elevated BP

History

- Birth/prematurity
- Sleep apnea symptoms
- Medications
- Diet/sodium intake
- Family Hx

Labs

- Urinalysis
- BMP
- Lipid panel
- ↑BMI
  - Work-up related comorbidities

Exam

- BMI
- BP in arm and leg
- Cardiac exam
- Abdominal bruit
- Endocrine signs

Confirmation

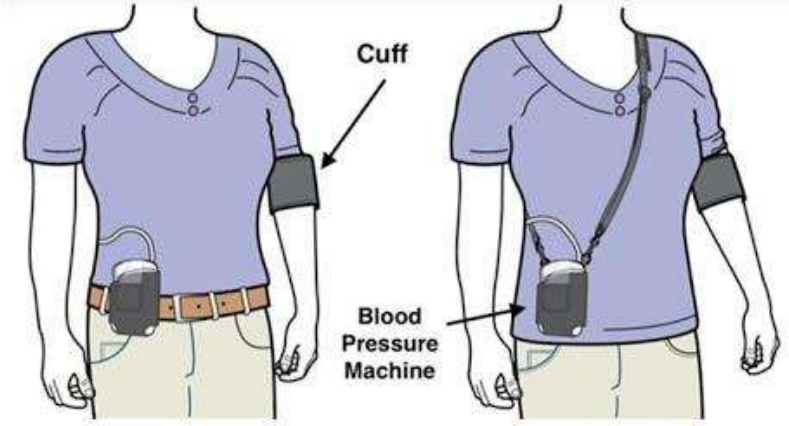
ABPM is the diagnostic standard

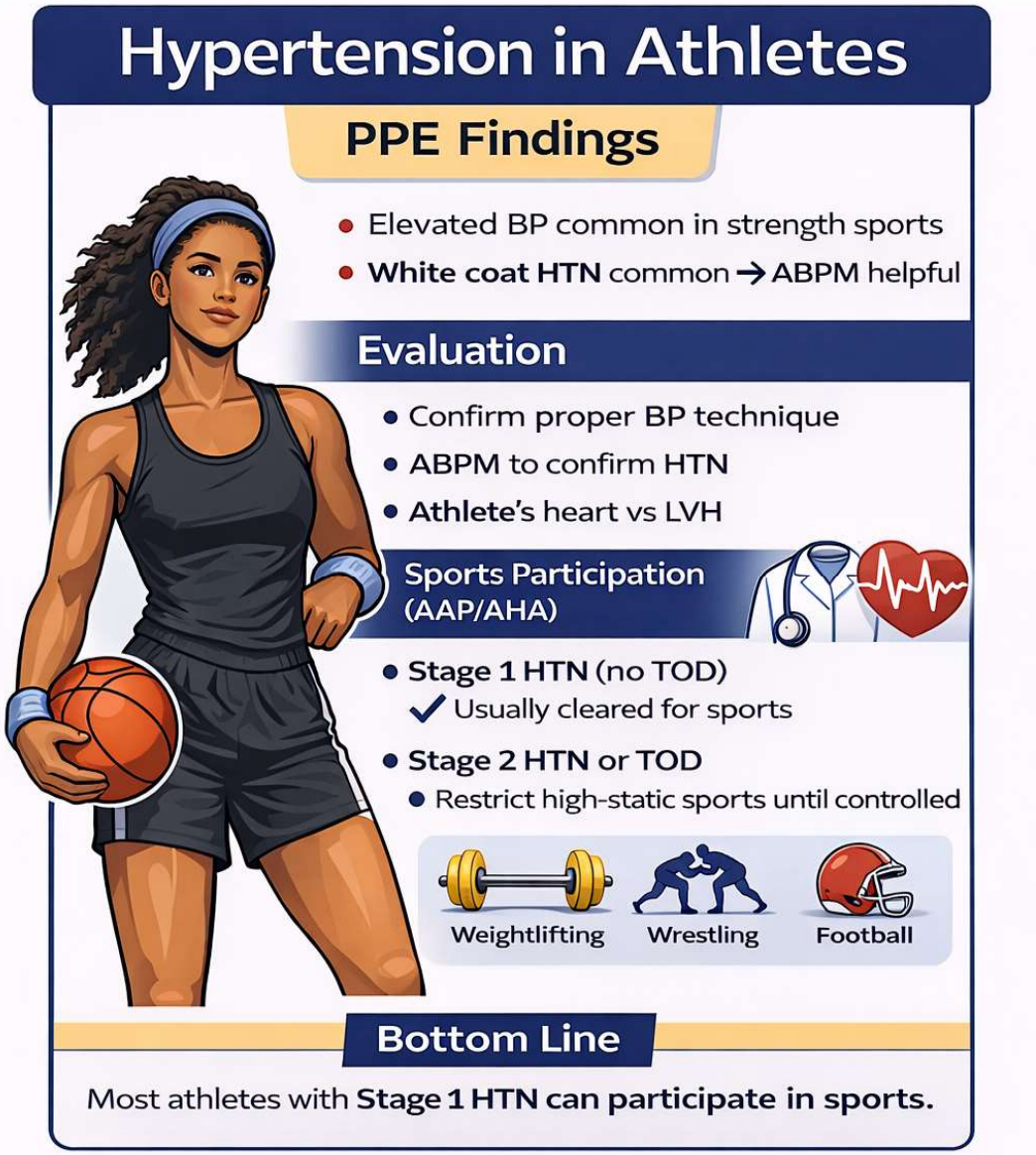
- Confirms HTN
- Identifies phenotype
- Helps guide targets

Get ABPM for:

- Elevated BP / Stage 1 HTN on repeated visits
- Suspected **white-coat** or **masked HTN**
- CKD, diabetes, obesity, post-coarct repair
- Discordant clinic BP

Home BP: adjunct only, **not diagnostic**





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High Static Sports

- BP load higher
- Weightlifting
- Wrestling
- Football line

Dynamic Sports

- BP load lower
- Soccer
- Basketball
- Running

PPE Pearls

- Most elevated BP is **white coat HTN**
- Repeat BP **+ ABPM** for diagnosis
- Distinguish athlete's heart vs LVH

Medication-Associated HTN in Children

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Common Medication Triggers

Stimulants
- Methylphenidate
- Amphetamine salts

Hormonal
- Oral contraceptives
- Testosterone therapy

Immunosuppressants
- Tacrolimus
- Cyclosporine
- Steroids

Respiratory / Allergy
- Decongestants
- High-dose beta agonists

Neurologic / Psychiatric
- SNRIs
- Bupropion

Other
- NSAIDs
- Erythropoietin
- Illicit substances

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ADHD Medications and Blood Pressure

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Myth	Fact
Stimulants ↑HTN significantly	BP ↑small SBP +2-4mmHg / DBP +1-2mmHg
Stop stimulants if BP rises	Most children remain normotensive
BP elevation is medication-related	Evaluate other causes first

Do not stop ADHD medications solely for mild BP elevation.
Monitor BP periodically and evaluate other causes.

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Secondary Hypertension

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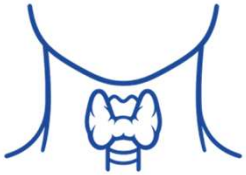
Age <6 years **Stage 2 HTN** **Abrupt onset/Severe HTN** **Abnormal exam/labs**

Renal Disease

Coarctation



Endocrine Disorders

Sleep Apnea

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High-Risk Populations

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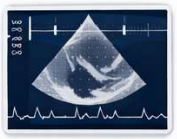
Obesity Most common driver of primary HTN	**Prematurity** Altered vascular development
Chronic Kidney Disease Leading cause of secondary HTN	**Sleep Apnea** Common contributor to elevated BP
Congenital Heart Disease Especially repaired coarctation	**Cancer Survivors** Cardiotoxic therapies and renal injury
Diabetes Accelerates vascular disease	**Transplant Recipients** Immunosuppressants and renal effects

Management of Pediatric Hypertension

Evaluation



Echo (once)

Assess LV mass / Target-organ damage

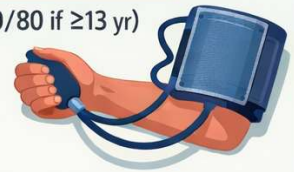
Start Medication If

- Symptomatic HTN
- Stage 2 HTN
- LVH or other TOD
- CKD or diabetes
- Persistent Stage 1 after 3–6 mo lifestyle

BP Targets

General: <90th %ile

(<130/80 if ≥13 yr)



CKD:

ABPM 24-hr MAP ≤50th %ile

Lifestyle Therapy (All Patients)

- DASH-style diet
- Sodium <1.5–2 g/day
- Activity & weight management
- Sleep optimization

Future Directions

- Risk-guided treatment based on TOD
- Emerging therapies for resistant HTN

Elevated BP

↓

Confirm HTN

↓

Lifestyle Rx

↓

Medications: Stage 2/TOD/↑ Risk

↓

BP Targets

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Antihypertensive Medications

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Class	Pros	Key Considerations
ACE inhibitors	• Pediatric data • Renoprotective • Once daily	• Cough • ↑K • ↑Cr • Teratogenic
ARBs	• No cough • Renoprotective	• ↑K • ↑Cr • Teratogenic
Calcium Channel Blockers	• Well tolerated • Once daily • Migraine prophylaxis	• Edema • Headache
Thiazide diuretics	• Inexpensive • Salt-sensitive HTN	• Electrolytes • Polyuria
Beta blockers	• Arrhythmia • Migraine	• Not first-line • Exercise intolerance

Early Intervention Matters

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Nutrition (DASH + ↓ sodium)

Evidence:
DASH-Y + Pediatric HTN studies
Impact:
↓ BP youth with obesity and HTN

Physical Activity

Evidence:
CDAH cohort + pediatric exercise studies
Impact:
Improved BP trajectories & vascular health

ACEi/ARB Therapy

Evidence:
ESCAPE trial + CKD pediatric studies
Impact:
Better BP control, ↓ LVH, ↓ proteinuria

Identify Early Risk

Evidence:
Longitudinal cohort studies
Impact:
↓ lifelong cardiovascular risk

Treating risks early can change lifelong CV outcomes.

Take-Home Messages

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1. **Pediatric HTN is common and often cardiometabolic.**
2. **Diagnosis depends on accurate BP measurement and confirmation.**
3. **Early recognition and treatment can change lifelong CV risk.**

Bottom line:
Childhood **BP matters because early action matters.**

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