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CLINICAL COURSE, RISK FACTORS AND REGIONAL PREVENTION PRIORITIES OF ARTERIAL HYPERTENSION IN CHILDREN

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ABSTRACT

This article analyzes the clinical course of arterial hypertension in children, diagnostic criteria, major risk factors, regional prevention priorities, and organization of monitoring in primary care. Pediatric blood pressure cannot be interpreted by one universal adult number, because in children younger than 13 years it depends on age, sex, and height percentiles. In adolescents, persistent blood pressure of 130/80 mmHg or higher is interpreted as hypertension. The article uses national clinical protocols, pediatric recommendations, UNICEF data on the school nutrition environment in Uzbekistan, international literature, and demographic indicators of the regions of Uzbekistan. Open official sources do not provide a complete region-by-region registry of pediatric hypertension prevalence. Therefore, the article does not invent regional prevalence rates. Instead, it presents a regional screening-priority framework based on population size, urbanization, school-age coverage, nutrition environment, excess weight risk, and ecological determinants.

Keywords: children, arterial hypertension, blood pressure, adolescents, screening, obesity, regional monitoring, prevention.

INTRODUCTION

Arterial hypertension in children was long considered a rare condition, usually secondary to kidney, endocrine, or cardiovascular disease. Contemporary pediatric practice shows that this view is incomplete. Excess body weight, sedentary behaviour, high-calorie diets, sweetened beverages, excessive salt intake, sleep disturbance, and psycho-emotional stress can raise blood pressure during childhood and adolescence. The most dangerous feature of pediatric hypertension is its silent course. A child may have no complaint at all, while repeated blood pressure measurements remain abnormal. Headache, fatigue, palpitations, dizziness, or reduced exercise tolerance often appear only after the process has become more stable. This makes routine screening more important than symptom-driven detection.

The significance of pediatric hypertension is increasing for two reasons. First, elevated blood pressure in childhood is an early marker of adult hypertension and future cardiovascular risk. Second, measuring blood pressure in a child is technically demanding. A wrong cuff size, anxiety, recent exercise, talking during measurement, or an unsupported arm can distort the result. A diagnosis should never be based on a single reading. Repeated measurements under standardized conditions, with an appropriate cuff and correct interpretation by age and height, are essential.

LITERATURE REVIEW

The literature describes pediatric hypertension as a multifactorial disorder. Primary hypertension is more common after the age of six and especially during adolescence; it is frequently

associated with obesity, family history, insulin resistance, high sodium intake, and insufficient physical activity. Secondary hypertension is relatively more common in younger children and may be caused by renal parenchymal disease, renovascular pathology, endocrine disorders, coarctation of the aorta, medication effects, or neurological conditions. For this reason, high blood pressure in a child younger than six years should not be casually explained as a lifestyle problem.

Current pediatric recommendations interpret blood pressure according to age. In children aged 1 to 12 years, normal pressure is below the 90th percentile for age, sex, and height. Values from the 90th to below the 95th percentile are classified as elevated blood pressure. Values at or above the 95th percentile suggest hypertension. From the age of 13 years, the criteria become closer to adult thresholds: 120–129/<80 mmHg is elevated blood pressure, 130/80–139/89 mmHg is stage 1 hypertension, and 140/90 mmHg or higher is stage 2 hypertension.

In Uzbekistan, a regional approach is important. Regions with large populations have a heavier burden on school medicine and family polyclinics. In the Aral Sea area, ecological and chronic stress factors may be relevant; in desert areas, heat and water-salt balance deserve attention; in large cities, fast food, sweetened drinks, screen time, school stress, and sedentary behaviour become more prominent. Therefore, one national protocol is not enough. A regional prevention package should also be developed.

Age group	Blood pressure assessment	Clinical interpretation	Practical action
1–12 years	Percentile by age, sex, and height	Not a single universal number	Correct cuff, rest, repeated measurements
13 years and older	120–129/<80 mmHg	Elevated blood pressure	Lifestyle assessment and repeat measurement
13 years and older	130/80–139/89 mmHg	Stage 1 hypertension	Medical evaluation and risk factor assessment
13 years and older	≥140/90 mmHg	Stage 2 hypertension	Prompt reassessment and specialist referral

MATERIALS AND METHODS

This article was prepared as an analytical review. The source base included the clinical guidance of the Ministry of Health of Uzbekistan, regional demographic data from the National Statistics Committee, UNICEF materials on the school nutrition environment in Uzbekistan, international pediatric hypertension recommendations, and local scientific papers. For the regional table, permanent population data as of July 1, 2025 were used. These figures are not presented as pediatric hypertension prevalence. They are used only as a demographic indicator for planning screening coverage and service load.

The analysis was organized around three questions: how does arterial hypertension clinically present in children, which diagnostic criteria should be used, and how should prevention and screening be prioritized across the regions of Uzbekistan. Where region-specific pediatric prevalence data were not available in official open sources, no numerical prevalence estimates were inserted.

This is a necessary methodological boundary. In medical writing, invented numbers may create false certainty and lead to poor public health decisions.

The regional assessment considered four practical indicators: total population size, urban or high-density living conditions, ecological or climatic features, and social factors that may increase the risk of excess weight and unhealthy nutrition. The regions were therefore grouped by screening priority rather than by disease incidence. This distinction matters. A high screening priority does not prove that the disease is more common; it only indicates where early detection systems need more capacity and coordination.

Analytical step	Content	Limitation	Effect on results
Source selection	National protocol, statistics, pediatric guidance	Open regional pediatric registry unavailable	No invented prevalence rates
Diagnostic assessment	Percentiles and adolescent threshold of 130/80	Height and sex tables are required	Single readings are not overinterpreted
Regional analysis	Population and prevention priority	Child-age share not fully separated	Screening load is estimated
Clinical recommendation	Lifestyle, evaluation, referral	Individual treatment depends on a physician	Article is not a prescription

The clinical course of pediatric hypertension can be grouped into three patterns. The first is silent or minimally symptomatic hypertension. The child appears healthy, but repeated screening measurements remain high. The second pattern includes autonomic or functional symptoms such as headache, fatigue, palpitations, sleep disturbance, and poor exercise tolerance. The third pattern is severe secondary hypertension, often seen in younger children or in children with renal, endocrine, or cardiovascular disease. This form may present with very high pressure, urinary abnormalities, unequal limb blood pressure, heart murmur, or abnormal laboratory findings.

The analysis identified three common clinical errors. The first is applying adult thresholds to young children. The second is diagnosing hypertension after one measurement. The third is explaining hypertension in an overweight child only by weight and ignoring renal or endocrine causes. In children younger than six years, secondary causes should be actively considered. In adolescents, primary hypertension is more common, but this does not eliminate the need for a structured evaluation.

Clinical pattern	Common features	Likely cause	Warning sign
Silent course	No complaints, high values only at screening	Early primary hypertension or measurement error	Repeated high readings
Autonomic course	Headache, fatigue, palpitations, sleep problems	Adolescence, stress, sedentary life, overweight	Poor exercise tolerance
Metabolic course	Obesity, increased waist circumference, insulin resistance	High-calorie diet and sweetened beverages	Dyslipidemia or abnormal glucose

Secondary course	Very high BP, young age, urinary findings	Renal, endocrine, vascular disease	High BP before six years or stage 2 hypertension

The school nutrition environment and family habits occupy a central role in prevention. Sweetened carbonated drinks, ultra-processed food, salty snacks, late high-calorie meals, and poor sleep influence blood pressure directly and indirectly. The pathway is not limited to obesity. It also includes sympathetic nervous system activation, insulin resistance, sodium retention, and reduced vascular elasticity.

REGIONAL ANALYSIS

The following table does not show pediatric hypertension prevalence by region. It shows priorities for preventive screening. This method is necessary because open official sources do not publish a complete regional registry of pediatric hypertension. In regions with larger populations, the coverage of screening must be broader. In urban areas, nutrition and sedentary behaviour deserve attention. In ecologically sensitive areas, general child health monitoring should be strengthened.

Region	Population thousand	Screening priority	Preventive note
Samarkand region	4,335.7	Very high	Large population and high school-age load; mass screening and training of school nurses in standard BP measurement are priorities.
Fergana region	4,181.0	Very high	High population density in the valley; body weight, salt intake, physical activity, and family history require close surveillance.
Kashkadarya region	3,673.7	High	Regions with high fertility create a heavier workload for primary care and school medicine.
Andijan region	3,487.9	High	Urbanization and changing dietary habits may increase the risk of obesity-related hypertension.
Namangan region	3,158.4	High	Dense population; early identification of overweight, stress, and sedentary behaviour among adolescents is required.
Tashkent city	3,145.2	High	Urban lifestyle, fast food, sweetened beverages, and screen time make school-family prevention essential.
Tashkent region	3,134.1	High	Mixed peri-urban and rural districts require a screening network that covers territorial heterogeneity.
Surkhandarya region	2,974.4	Medium-high	Hot climate, physical workload, and dietary patterns should be considered in pediatric follow-up.
Bukhara region	2,089.4	Medium	Desert climate and water-salt balance factors need attention in preventive counselling.

Khorezm region	2,045.7	Medium	Aral Sea area influences and dietary patterns justify stronger cardiovascular monitoring.
Republic of Karakalpakstan	2,040.7	Medium-high	Aral Sea ecological conditions, chronic stress, and nutrition quality make child health screening especially important.
Jizzakh region	1,551.7	Medium	Interdistrict distance and access to care call for mobile screening mechanisms.
Navoi region	1,103.3	Medium	Industrial zones, family work patterns, and continuity of child supervision should be assessed.
Syrdarya region	938.5	Relatively low	Smaller population makes full screening coverage and registry maintenance more feasible.

The key regional conclusion is that, without a unified electronic registry, school screening and family polyclinic records remain fragmented. Children at risk may not be recalled for repeat assessment, while others may be mislabeled as hypertensive after one abnormal reading. Each region should collect at least four indicators systematically: age, sex and height-adjusted blood pressure percentile, body mass index, family history, and repeat measurement result.

DISCUSSION

The main practical weakness in pediatric hypertension control is inconsistent measurement culture. If the cuff is too small or too large, if a child has just been running, or if the arm is unsupported, the value may be falsely high. The opposite is also possible: true hypertension may be missed because one reading was normal. The measurement protocol must therefore be strict. The child should sit quietly for five minutes, feet on the floor, arm supported at heart level, appropriate cuff size used, and at least two readings recorded.

Obesity has a major role in the pathogenesis of pediatric hypertension. Adipose tissue is not merely an energy store; it is hormonally active. Obesity increases sympathetic nervous system tone, activates the renin-angiotensin-aldosterone system, and promotes sodium and water retention. These mechanisms increase vascular resistance and raise blood pressure. During adolescence, hormonal changes, insufficient sleep, academic stress, and social pressure can amplify these pathways.

Nevertheless, it is unsafe to explain all hypertension by obesity. A child with normal weight may have renal disease, coarctation of the aorta, thyroid or adrenal pathology, medication-induced hypertension, or genetic predisposition. In practice, this is often missed. If the child is very young, if blood pressure is in the stage 2 range, if upper and lower limb pressures differ, if urinary tests are abnormal, or if the family history includes early cardiovascular disease, a deeper evaluation is mandatory.

Risk factor	Mechanism	Detection	Preventive action
Excess weight	RAAS activation, sodium retention, insulin resistance	BMI, waist circumference, diet history	Gradual weight control and family diet plan
High-salt diet	Fluid retention and vascular resistance	24-hour dietary history	Reduce salt and salty snacks

Sedentary behaviour	Low energy use and poor vascular tone	Daily activity and screen-time review	30–60 minutes active movement 3–5 days weekly
Family history	Genetic and shared lifestyle effects	History of parental hypertension	Early screening and home follow-up
Renal disease	Fluid and electrolyte imbalance	Urinalysis, creatinine, ultrasound	Nephrologist assessment

PRACTICAL RECOMMENDATIONS

Reducing pediatric hypertension requires a small but functional set of actions. First, blood pressure should be measured at least once a year from the age of three during preventive visits. Second, children with excess weight, renal disease, diabetes, family history of hypertension, congenital heart disease, or long-term medication use should have blood pressure checked at every medical encounter. Third, school nurses need training in cuff selection and percentile interpretation. Fourth, a child with a high value should not immediately be labeled as ill; the correct label is a child who needs repeated measurement and physician assessment.

Management should be stepwise. In elevated blood pressure and stage 1 hypertension, the first approach is lifestyle correction: normalization of body weight, reduction of sweetened beverages, salt restriction, increased fruit and vegetable intake, better sleep hygiene, reduced screen time, and regular physical activity. Drug treatment should be prescribed only by a physician. Stage 2 hypertension, symptomatic hypertension, renal disease, diabetes, left ventricular hypertrophy, or persistent high pressure despite lifestyle correction require specialist assessment without delay.

Health-care level	Task	Required tool	Expected result
School	Correct measurement and risk group identification	Pediatric cuffs, screening card	Early detection of silent cases
Family polyclinic	Repeated measurement, BMI, basic labs	Percentile chart, electronic record	Diagnostic clarification
Pediatrician	Differentiate primary and secondary hypertension	History, examination, urine and blood tests	Appropriate referral
Cardiologist or nephrologist	Evaluate complex cases	ECG, echocardiography, ultrasound, ABPM	Prevention of complications

CONCLUSION

Arterial hypertension in children is a relevant problem for pediatrics and public health. Its danger lies in the fact that it is often asymptomatic while increasing future cardiovascular risk. Diagnosis requires age, sex, and height-adjusted percentiles in younger children and clear numerical thresholds in adolescents. One measurement can never be a final diagnosis. Regional planning in Uzbekistan should openly acknowledge the absence of complete official pediatric prevalence tables by region. Screening priority can be defined using population size and risk-factor context, but not by invented prevalence rates. The most effective strategy is continuous data exchange between schools,

family polyclinics, pediatricians, cardiologists, and nephrologists. This would allow early detection of high blood pressure, avoid unnecessary alarm, and keep truly high-risk children under proper follow-up.

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