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Narrative Review

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Early-Onset Hypertension: A Lifelong Burden and the Unmet Need for Transitional Care–A Narrative Review

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ABSTRACT

Early-onset hypertension (EOH) is an increasingly recognized contributor to adult cardiovascular disease, with its prevalence rising due to obesity, poor dietary patterns, and genetic predisposition. Elevated blood pressure beginning in childhood often persists into adulthood, significantly increasing the risk of target organ damage and long-term cardiovascular morbidity. This narrative review synthesizes evidence from major longitudinal cohort studies to highlight the pathophysiological progression of EOH and the challenges associated with its management, particularly during the transition from pediatric to adult care. Despite the established association between childhood hypertension and adverse cardiovascular outcomes, current healthcare systems lack structured transition protocols, leading to fragmented care and poor adherence among adolescents. The review emphasizes the urgent need for integrated transition models, early detection through school-based screening, lifestyle interventions, and enhanced provider training. Addressing these gaps is essential to mitigate the lifelong burden of EOH and improve cardiovascular outcomes across the lifespan.

Key-words: Adherence, Cardiovascular risk, Early-onset hypertension, Obesity, Pediatric hypertension, Transition care

INTRODUCTION

According to the National Health and Nutrition Examination Survey from 2011 to 2014, 29% of adults have hypertension, with non-Hispanic Blacks having the highest prevalence of 41.2% [1]. Twenty-five years ago, the prevalence of pediatric hypertension in the USA was approximately 0.3–1.2%. Current data suggest that at least 1 in 10 children is prehypertensive, while 4 in 100 children are hypertensive [2].

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This upsurge is attributed to the obesity epidemic and high salt intake, risk factors similar to those for adult primary hypertension [2-4]. According to the World Health Organization, adult hypertension is the leading risk factor for morbidity in middle-income countries and second only to tobacco in low- and high-income countries [5,6].

Hypertension traditionally considered an adult condition, is now increasingly diagnosed in children and adolescents, with a global prevalence of 3–5%, rising further among those with obesity or a family history of hypertension [7,8]. This shift necessitates a reevaluation of hypertension as a chronic, lifelong condition beginning in youth.

Risk factors for pediatric primary hypertension are not clearly defined. Children with obesity are at increased risk, consistent with the known relationship between

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adiposity and elevated BP [9-11]. However, not all studies show a direct link between rising childhood obesity and hypertension rates, suggesting additional contributing factors [12].

Longitudinal data confirm that elevated BP in childhood strongly predicts adult hypertension and cardiovascular events [13,14]. However, systems for long-term management and tracking remain underdeveloped [15,16].

Table 1. BP Categories and Staging in Children and Adolescents [17]

BP Category	Children (1–<13 years)	Adolescents (≥13 years)
Normal BP	< 90th percentile and <120/80 mm Hg	<120/<80 mm Hg
Elevated BP	≥ 90th to <95th percentile or 120/80 to <95th percentile	120–129/<80 mm Hg
Stage 1 Hypertension	≥95th percentile or 130/80–139/89 mm Hg (whichever is lower)	130/80–139/89 mm Hg
Stage 2 Hypertension	≥95th percentile and ≥12 mm Hg above that or ≥140/90 mm Hg	≥140/90 mm Hg

Current Understanding and Evidence

Epidemiology and Persistence of Early-Onset Hypertension- Early-onset hypertension (EOH) has seen a marked increase in prevalence over recent decades. Once considered rare in pediatric populations, recent epidemiological surveys show that nearly 10% of children are now prehypertensive, and up to 4% are hypertensive. The prevalence is highest among those with obesity, low birth weight, and a family history of hypertension. Notably, children with elevated blood pressure (BP) often remain hypertensive into adulthood, with persistence rates between 30–60% [13–15].

Table 2: Global Prevalence of Pediatric Hypertension by Region

Region	Prevalence of Pediatric Hypertension (%)	Key Risk Contributors
North America	3–5%	Obesity, dietary salt
Europe	2–4%	Obesity, sedentary lifestyle
Asia	1–3%	Low birth weight, salt intake
Sub-Saharan Africa	<2%	Underdiagnosis, low screening

Pathophysiology and Risk Factors- EOH is multifactorial in origin. Primary risk factors include obesity, sedentary behavior, poor dietary habits (particularly high sodium intake), and genetic predisposition. Secondary hypertension, more common in children than in adults, may result from renal or endocrine causes [9–11,21,22]. Early vascular remodeling, sympathetic overactivity, and endothelial dysfunction contribute to long-term disease progression [13,15].

Table 3: Risk Factors for Early-Onset Hypertension and Strength of Evidence

Risk Factor	Type	Strength of Evidence	Notes
Obesity	Modifiable	Strong	Correlates with elevated systolic BP
Low birth weight	Non-modifiable	Moderate	Stronger association in preterm infants
High sodium intake	Modifiable	Strong	Especially in processed food consumers
Renal abnormalities	Non-modifiable	Strong	Secondary cause in 5–10% of cases

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Evidence from Longitudinal Cohort Studies- Longitudinal studies such as the Bogalusa Heart Study, Framingham Heart Study, and CARDIA study show that childhood BP tracks into adulthood and correlates with cardiovascular outcomes such as left ventricular hypertrophy (LVH), arterial stiffness, and carotid intima-media thickness [13,15].

Table 4: Longitudinal Findings: Childhood BP and Adult Cardiovascular Risk

Study	Key Finding	Implication
Bogalusa Heart Study	Childhood BP predicts adult arterial thickening	Early detection critical
Framingham Study	High adolescent BP linked with adult LVH	Supports BP tracking into adulthood
CARDIA Study	Youth BP correlates with subclinical atherosclerosis	Justifies early lifestyle interventions

Clinical Consequences and Target Organ Damage- Persistently elevated BP in youth can lead to early onset of target organ damage (TOD), including LVH, increased carotid intima-media thickness, microalbuminuria, and retinal changes. These effects often precede overt cardiovascular disease [13-15,18,19].

Table 5: Early-Onset Hypertension and Associated Target Organ Damage

Organ System	Clinical Manifestation	Mechanism
Cardiovascular	Left ventricular hypertrophy	Increased afterload
Renal	Microalbuminuria, elevated Cr	Glomerular hyperfiltration, ischemia
Neurological	Cognitive delay, headaches	Reduced cerebral perfusion
Ophthalmologic	Retinal arteriolar narrowing	Chronic endothelial stress

Barriers to Effective Transitional Care- Adolescents with EOH face multiple systemic and individual barriers during the shift from pediatric to adult care. These include poor EMR linkage, inadequate provider training, lack of family support, and low adherence to medical therapy [15,21,22,24,25,27].

Table 6: Barriers to Transition in Care for Pediatric Hypertension

Category	Barrier	Description
Patient-related	Poor adherence, low-risk perception	Adolescents skip follow-ups, lack urgency
Psychosocial	Depression, poor health literacy	Limits engagement and understanding
System-level	No EMR integration	Loss of continuity between pediatric and adult care
Provider-related	Lack of transition training	Adult physicians unaware of pediatric history
Family-related	Low involvement, poor supervision	Inconsistent monitoring, missed appointments

Strategies for Intervention and Future Directions- Efforts to manage EOH must span from prevention to structured transition protocols. Lifestyle modifications are foundational, but large-scale pediatric trials are lacking [23,24,28,29]. Technology-driven adherence tools, school-based screening, and transition clinics offer promising pathways. Precision medicine and individualized risk stratification may further optimize care [30].

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Table 7: Current and Emerging Strategies for EOH Management

Strategy	Evidence Level	Target Population	Implementation Barrier
Lifestyle intervention (DASH + exercise)	Moderate	All pediatric patients	Adherence, access
Digital monitoring apps	Low–moderate	Tech-literate adolescents	Digital divide, usability
School-based BP screening	Moderate	6–17 years old	Resource variability
Structured transition clinics	Emerging	14–21 years old	Requires interdepartmental link

CONCLUSIONS

Early-onset hypertension is a lifelong condition with roots in childhood and adolescence, often progressing silently into adulthood with significant cardiovascular consequences. Despite strong evidence linking childhood BP with adult disease, major gaps remain in early detection, sustained management, and transitioning from pediatric to adult care. The tables presented highlight persistent epidemiological trends, pathophysiological underpinnings, and systemic failures, underscoring the urgency of comprehensive, lifelong care strategies.

A paradigm shift is required—from reactive adult treatment to proactive pediatric surveillance and structured transitional care. Implementing school-based screenings, digital health tools, and integrated transition programs will be key to improving long-term outcomes. Additionally, investment in pediatric-specific research and provider training can bridge the current gaps. Addressing these challenges head-on is essential to mitigate the future burden of cardiovascular disease and ensure healthier trajectories for today's youth.

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