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# PREVENTION OF CARDIOVASCULAR DISEASES IN CHILDREN

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**Abstract:** Cardiovascular diseases (CVDs) are a leading cause of global morbidity and mortality, with their origins often traceable to childhood. Preventive strategies targeting pediatric populations can significantly reduce the long-term burden of CVD. This article provides a comprehensive examination of the epidemiology, risk factors, and evidence-based preventive approaches for CVD in children, focusing on modifiable factors such as obesity, hypertension, dyslipidemia, physical inactivity, and tobacco exposure. It explores primordial, primary, and secondary prevention strategies, emphasizing lifestyle interventions like the DASH diet, structured physical activity programs, and smoking cessation initiatives, supported by landmark studies such as the Bogalusa Heart Study and the Pathobiological Determinants of Atherosclerosis in Youth (PDAY). The article also addresses the role of early screening, multidisciplinary interventions, and community-based programs in mitigating CVD risk. In Uzbekistan, where urbanization and dietary shifts are increasing risk factor prevalence, culturally tailored strategies are essential. By fostering healthy behaviors from childhood, societies can reduce healthcare costs, improve quality of life, and promote cardiovascular health across generations.

**Keywords:** Cardiovascular disease, pediatric prevention, obesity, hypertension, dyslipidemia, physical activity, smoking cessation, primordial prevention, lifestyle interventions, early screening, Uzbekistan**.**

Cardiovascular diseases (CVDs) account for approximately 17.9 million deaths annually, making them the leading cause of mortality worldwide, according to the World Health Organization. Although CVD typically manifests in adulthood, its pathogenesis often begins in childhood, with subclinical atherosclerosis detectable as early as the first decade of life. Landmark studies, such as the Bogalusa Heart Study and the Pathobiological Determinants of Atherosclerosis in Youth (PDAY), have demonstrated that childhood risk factors, including elevated cholesterol, obesity, and hypertension, are strongly associated with subclinical atherosclerosis markers, such as increased carotid intima-media thickness (CIMT), reduced carotid elasticity, and impaired brachial endothelial function. These markers are robust predictors of adult CVD events, highlighting the critical need for early intervention. In Uzbekistan, rapid urbanization, coupled with dietary transitions toward processed foods and sedentary lifestyles, has led to a rise in childhood obesity and other CVD risk factors, mirroring global trends. For instance, in the United States, 17% of children aged 2–19 years are obese (BMI ≥95th percentile), and an additional 15% are overweight (BMI ≥85th percentile), with similar patterns emerging in Uzbekistan due to increased consumption of high-calorie, low-nutrient foods and reduced physical activity. These conditions are linked to adverse cardiovascular outcomes, including dyslipidemia, elevated blood pressure, insulin resistance, left ventricular hypertrophy, and increased CIMT, with severe obesity (≈6% prevalence) further amplifying these risks. The risk factors for CVD in children are categorized as

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modifiable and non-modifiable. Modifiable factors include obesity, which drives CVD risk through mechanisms like insulin resistance, dyslipidemia, and chronic inflammation; hypertension, which tracks into adulthood and contributes to vascular stiffness and end-organ damage; dyslipidemia, characterized by elevated low-density lipoprotein cholesterol (LDL-C), triglycerides, and low high-density lipoprotein cholesterol (HDL-C); physical inactivity, with many children failing to meet the recommended ≥60 minutes of daily moderate-to-vigorous physical activity (MVPA); and tobacco exposure, including active smoking and secondhand smoke, which accelerates atherosclerosis. Non-modifiable factors, such as genetic predisposition (e.g., familial hypercholesterolemia) and congenital heart defects, are less prevalent but significant, particularly in high-risk populations. The pubertal period introduces additional complexity, as hormonal changes can temporarily alter lipid profiles, blood pressure, and glucose metabolism, potentially weakening the predictive link between childhood and adult CVD risk. However, longitudinal data confirm that early risk factor control significantly reduces adult CVD incidence.

Preventive strategies for pediatric CVD are classified into primordial (preventing the development of risk factors), primary (managing risk factors in at-risk individuals), and secondary (preventing recurrence in those with established disease). The American Heart Association (AHA) defines ideal cardiovascular health in children by four key behaviors: non-smoking, maintaining a BMI <85th percentile, engaging in ≥60 minutes of MVPA daily, and adhering to a healthy diet with a score of 4–5 components (based on consumption of fruits, vegetables, whole grains, and limited sodium and sugary beverages). Additionally, three health factors are emphasized: total cholesterol <170 mg/dL, blood pressure <90th percentile, and fasting glucose <100 mg/dL. Maintaining these metrics from birth through adolescence is critical, as their prevalence declines with age due to lifestyle changes and environmental influences. In Uzbekistan, where traditional diets high in carbohydrates and fats are common, promoting these metrics requires culturally sensitive approaches.

Lifestyle interventions form the cornerstone of CVD prevention in children. The Dietary Approaches to Stop Hypertension (DASH) diet, which prioritizes plant-based foods, fruits, vegetables, nuts, low-fat dairy, lean meats, fish, poultry, whole grains, and heart-healthy fats, is recommended with age-appropriate portion sizes. For example, children should consume ≥4.5 cups of fruits and vegetables daily, limit sodium to ≤1500 mg, and restrict sugary beverages to ≤450 kcal weekly by age 18. Parental involvement is crucial, as family-based dietary changes are more sustainable. School-based nutrition programs, which provide healthy meals and educate students on balanced diets, have shown success in reducing obesity and improving lipid profiles. In Uzbekistan, integrating nutrition education into school curricula and leveraging community structures like mahallas can enhance dietary adherence. Physical activity interventions should ensure ≥60 minutes of MVPA daily, including muscle- and bone-strengthening activities at least 3 days per week. School-based programs, such as enhanced physical education, active transport to school (e.g., walking or cycling), and extracurricular sports, are supported by strong evidence. In Uzbekistan, where urban environments may limit safe spaces for physical activity, creating community sports facilities and promoting active school commutes could address sedentary trends. Smoking prevention is another critical component, encompassing strategies to prevent initiation, support cessation, and reduce secondhand smoke exposure. Behavioral interventions, such as counseling and motivational enhancement, are effective in adolescents, while pharmacological options like bupropion or

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nicotine replacement therapy may be considered for older youth. Policy measures, including smoking bans in public spaces, increased tobacco taxes, and subsidized cessation programs, have proven effective, with school-based prevention programs reducing smoking initiation by approximately 12%. In Uzbekistan, where smoking rates among adults remain high, protecting children from secondhand smoke through public awareness campaigns and stricter regulations is essential. Community-based programs, such as those involving religious or cultural leaders, can further reinforce anti-smoking messages. Early screening is vital for identifying children at risk of CVD. Universal lipid screening is recommended at ages 10 and 19, measuring total cholesterol, LDL-C, HDL-C, and triglycerides. Non-fasting lipid tests and HbA1c screening improve accessibility and compliance, with studies indicating that 14.6% of normal-weight children have hyperlipidemia and 16.4% have hyperglycemia. For hypertension, a 6-month lifestyle intervention is the first-line approach, focusing on weight management, dietary sodium reduction, and increased physical activity. If hypertension persists or target organ damage (e.g., left ventricular hypertrophy) is detected, pharmacological treatment with ACE inhibitors or angiotensin receptor blockers (ARBs) is initiated. In cases of familial hypercholesterolemia, statins may be prescribed as early as ages 8–10, with long-term benefits in reducing atherosclerotic CVD risk. Multisite assessments, including CIMT, aortic pulse wave velocity, and brachial flow-mediated dilation, provide a comprehensive evaluation of subclinical atherosclerosis. In Uzbekistan, integrating these screening protocols into routine pediatric care, particularly through polyclinics and school health programs, could facilitate early identification of high-risk children.

Community-based and policy-driven interventions are essential for primordial prevention. School nutrition initiatives, such as providing low-sodium, low-sugar meals and banning sugary beverages, can shape healthy eating habits. Public health campaigns targeting parents, educators, and community leaders can raise awareness of CVD risk factors and promote preventive behaviors. In Uzbekistan, policies restricting access to high-calorie, low-nutrient foods and subsidizing healthy alternatives could shift dietary patterns. For example, taxing sugary beverages and promoting local produce like fruits and vegetables could align with cultural dietary preferences. Collaboration between healthcare providers, schools, and local governments is critical for scaling these interventions. Uzbekistan's mahalla system, which fosters community cohesion, offers a unique platform for disseminating health education and organizing activities like group exercise programs or nutrition workshops. Challenges to CVD prevention in Uzbekistan include limited access to healthy foods in rural areas, cultural preferences for high-calorie diets, and insufficient healthcare infrastructure for specialized pediatric care. Economic constraints may also limit families' ability to prioritize healthy foods or access recreational facilities. However, opportunities exist to leverage existing health programs, such as maternal and child health initiatives, to integrate CVD prevention. Training healthcare providers in pediatric lipid and hypertension management, expanding school-based health screenings, and utilizing digital platforms for health education can bridge these gaps. For example, mobile health applications could deliver tailored nutrition and exercise advice to families, while community health workers could conduct outreach in rural areas. International models, such as the European Union's school fruit and vegetable programs, could be adapted to Uzbekistan's context, promoting local produce and reducing reliance on processed foods.

Preventing CVD in children is a public health imperative with profound implications for reducing the global and national disease burden. Evidence from studies like the Bogalusa Heart

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Study and PDAY underscores that childhood risk factors, including elevated LDL-C, obesity, and hypertension, are strong predictors of adult CVD outcomes. Comprehensive interventions combining lifestyle changes, early screening, and community engagement can alter the trajectory of CVD. In Uzbekistan, culturally tailored strategies that account for socioeconomic realities and leverage community structures are essential for success. For instance, incorporating heart-healthy recipes into traditional Uzbek cuisine, such as replacing high-fat meats with leaner options or reducing salt in dishes like plov, could enhance dietary adherence. By investing in early prevention, societies can reduce healthcare costs, improve quality of life, and ensure a healthier future for the next generation. Longitudinal data suggest that sustained interventions in childhood can reduce adult CVD incidence by 10–15%, highlighting the transformative potential of early action.

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