

## VIEWPOINT

# Preventive Cardiology in High-Risk Adolescents and Young Adults



## Is the Current Training Sufficient?

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### HIGH-RISK CARDIOVASCULAR PROFILES

Cardiovascular disease (CVD) is the leading cause of death in the United States.<sup>1</sup> Despite overall declines in mortality, there are increasing rates of early-onset heart failure and acute myocardial infarction in young adults.<sup>2</sup> High-risk cardiovascular profiles often begin in youth and are frequently under-addressed, leading to gaps in care and early CVD events. The Framingham Heart Study played a pivotal role in identifying major risk factors of CVD.<sup>3</sup> Elaborating on CVD risk factors, the American Journal of Preventive Cardiology underscores high cholesterol, high blood pressure, type 2 diabetes mellitus (T2DM), physical inactivity, cigarette smoking, obesity, and abdominal obesity as significant contributors.<sup>3</sup>

Childhood obesity, 1 of America's most significant health threats, increases the risk of CVD through various mechanisms via genetic, socioeconomic, psychosocial, and environmental interactions.<sup>1,4,5</sup> Nearly one-third of American children and adolescents are overweight or obese.<sup>4</sup> Obesity is widely acknowledged as a major contributor to the progression of atherosclerotic changes in children. A recent study including approximately 2.3 million individuals found a 2- to 3-fold increase in CVD mortality among individuals who met criteria for overweight or obesity as adolescents compared to

adolescents with normal weight.<sup>4</sup> Notably, elevated measures of central adiposity, such as waist circumference and waist-to-hip ratio, have consistently indicated an increased susceptibility to coronary artery disease and CVD mortality, irrespective of individuals' body mass index levels. The Bogalusa Heart Study further underscores the significant association between long-term obesity and the substantial burden of CVD that emerges early in childhood. Obesity is intertwined with various risk factors, which collectively comprise a complex interplay of 4 components: central obesity, insulin resistance, hypertension, and hyperlipidemia.<sup>5</sup>

Diabetes mellitus is associated with an increased risk of developing CVD. According to the Centers for Disease Control and Prevention, between 2001 and 2017, the number of people living with type 1 diabetes increased by 45%, and the number living with T2DM increased by 95%. While macrovascular disease is unlikely to occur in youth, vascular abnormalities and arterial stiffness have been found in adolescents.<sup>1,2</sup> Notably, evidence suggests early-onset T2DM progresses more rapidly and is associated with a higher risk of cardiovascular complications compared to individuals with type 1 diabetes or those who develop diabetes later in life.<sup>2</sup> These findings highlight the need for effective prevention and management strategies to mitigate the rising burden of diabetes and its associated complications.

Dyslipidemia, another risk factor for CVD, has increased in adolescents and young adults.<sup>1,2</sup> Approximately 25% of adolescents have at least 1 component of their lipid profile in the adverse range.<sup>1</sup> Individuals with familial hyperlipidemia have a higher risk of developing CVD.<sup>2,4</sup> While the prevalence of familial hyperlipidemia is 0.33%, individuals

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with atherosclerotic CVD are 180% more likely to have familial hyperlipidemia.<sup>4</sup> Thus, there is a need for increased screening for familial hypercholesterolemia and effective therapy, especially in children and young adults whose parents have had an early cardiovascular event.<sup>1,2</sup>

Both primary and secondary hypertension are significant risk factors for CVD.<sup>1</sup> The prevalence of hypertension in young adults has increased, with nearly 37% of adults aged 18 to 44 years having hypertension.<sup>2</sup> One longitudinal study with over 5,000 young adults found that groups with elevated blood pressure or those with increasing trajectories over time had increased odds of having a coronary artery calcium score >100 at year 25.<sup>6</sup> Other risk factors contributing to high-risk youth cardiovascular profiles include chronic kidney disease, inflammatory conditions such as lupus nephritis or juvenile arthritis, Kawasaki disease, congenital heart disease, and smoking.<sup>1,2</sup>

Structural and functional changes represent the most compelling evidence of childhood-onset CVD.<sup>5</sup> Autopsy studies conducted on young men, average age 22 years, during the Vietnam War revealed atherosclerosis in their coronary arteries.<sup>3</sup> Additionally, autopsies on young individuals who suffered accidental deaths in the Bogalusa study, as well as those involved in the Pathologic Determinants of Atherosclerosis in Youth study, demonstrated the presence of fatty streaks and raised fibrous plaques in coronary arteries of individuals in their 20s and 30s.<sup>5</sup> Importantly, it has been noted that the age and duration of exposure to these risk factors influence the severity of the disease.<sup>5</sup>

### CHALLENGES IN CVD PREVENTION AMONG PEDIATRIC AND YOUNG ADULT POPULATIONS

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Early-onset CVD, combined with increased prevalence in CVD risk factors, highlight the need for early prevention. However, numerous challenges exist, including lack of risk assessment tools, lack of updated standardized guidelines, unique psychosocial factors specific to the population, and social determinants of health.

The lack of age-appropriate risk assessment tools poses one of the greatest challenges in CVD prevention in pediatric and young adult patients. While the atherosclerotic vascular disease lifetime risk calculator, based on the 2018 cholesterol guidelines, has been expanded to include 20- to 40-year-olds, data are based on risk factors from individuals aged >45 years.<sup>2</sup> This lifetime calculator also overlooks individuals below age 20 years. Expanding the

lifetime risk calculator to include adolescent patients is essential to address the rising CVD burden. It is also vital to develop an atherosclerotic vascular disease risk tool that can assess the 10-, 20-, and 30-year risk for adults under age 40.<sup>2</sup> A recent *JACC* State-of-the-art Review makes several noteworthy observations. Firstly, although individuals aged 20 to 39 years have a relatively low 10-year risk, their 30-year risk can be significantly higher, particularly among smokers, surpassing a 3-fold increase in the 10-year risk. This is particularly important given the trend of early-onset CVD and may aid in counseling in this age group.<sup>2</sup> Finally, pediatric and adult cardiologists must collaborate to develop and implement risk assessment tools and updated guidelines that address specific medical requirements and psychosocial challenges that occur in this population.

The absence of standardized prevention measures for high-risk pediatric patients and young adults, along with the increasing rates of obesity, type 2 diabetes, and hyperlipidemia, underscores the necessity for updated screening guidelines. Despite the American Heart Association's recommendations for hyperlipidemia and blood pressure screening, there are still potential gaps in detection. Comprehensive, timely screening is particularly crucial for youth with multiple CVD risk factors. By addressing these challenges, health care providers can proactively minimize the long-term effects of these conditions on the cardiovascular health of young individuals.

The psychosocial challenges of adolescents and young adults present another obstacle. Unhealthy lifestyle choices (eg, excessive alcohol consumption, sedentary behavior, and smoking) and mental health conditions, such as depression and anxiety, are prevalent among this group and may have a cumulative effect on cardiovascular health over time.<sup>7</sup>

Social determinants of health, such as poverty, lack of access to healthy food options, and exposure to environmental toxins, can also impact cardiovascular health in young people. These factors can contribute to the development of cardiovascular risk factors and make their effective management challenging. In addition to establishing a framework focused on addressing earlier prevention strategies, care must be taken to prepare trainees to assess and intervene where possible on environmental and social determinants of health.

### THE SIGNIFICANCE OF PRIMORDIAL PREVENTION

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Cardiovascular primordial prevention focuses on improving population-based metrics, thereby

preventing the emergence of CVD risk factors by promoting healthy lifestyles and minimizing modifiable risk factors.<sup>3</sup> The goal is to decrease the occurrence of CVD by implementing effective approaches at a population level.<sup>3</sup> One study involving 51,505 children found that 90% of 3-year-olds with obesity remained overweight or obese during adolescence.<sup>7</sup> Early intervention to address risk factors is crucial in preventing CVD later in life.

Several programs have focused on primordial prevention in young school-aged children. Salud-integral comprehensive health is a program aimed to promote lifestyle changes and encourage long-lasting health behaviors in preschool students.<sup>7</sup> After 10 years of experience, program review emphasizes the importance of a multidisciplinary team, the development of education programs, and the need for coordination and community engagement in implementing effective interventions.<sup>7</sup> Project Healthy Schools aimed to decrease CVD risk factors in sixth graders through incentive programming, environmental changes, and frequent evaluation of outcome measures. Similar to the Salud-integral comprehensive health program, this program included multidisciplinary educational programming and a multidisciplinary team, including parents and teachers, university students, volunteers to assist with screenings (eg, body mass index, blood pressure, glucose, cholesterol panel, and behavioral screenings), pediatric cardiologists, and other community partners.<sup>8</sup> Common components of these interventions clearly demonstrate the importance of an interdisciplinary approach involving various health care and community professionals, addressing young people's unique medical and psychosocial challenges.

## TRAINING THE NEXT GENERATION OF PHYSICIANS

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The ongoing surge in CVD burden, coupled with an alarming increase in CVD risk factors in our young population, demands urgent action. Efforts directed at this health crisis should include creating standardized guidelines and expanding prevention training focused on the early years when impactful changes can best be made. The Accreditation Council for Graduate Medical Education fellowship training requirements for pediatric and adult cardiology all describe commonalities in which trainees should be competent for the prevention of CVD. Although this is a powerful statement, clarity is needed to establish

core competencies to achieve this goal in what has now become a rapidly evolving field. Coordination of these competencies with American Board of Pediatrics, American Board of Internal Medicine, American Board of Family Medicine, and the respective Accreditation Council for Graduate Medical Education residency programs is necessary to reach the communities and patients in need.

Currently, the Core Cardiovascular Training Symposium (COCATS) 4 provides guidance on training in prevention for all general cardiology fellows,<sup>9</sup> however, primordial prevention is not captured in this training document. A survey of cardiology fellowships in the United States demonstrated that less than one-fourth of programs met the existing COCATS prevention requirements, with many noting a "lack of developed curriculum in prevention" as a key factor.<sup>10</sup>

Preventive cardiology in high-risk adolescents and young adults, as recommended in COCATS 4, is a topic well suited for collaborative efforts in creating a framework for standardized training across pediatric and adult cardiology training programs. Many cardiology programs have begun to develop advanced fellowships in cardiovascular prevention to better meet the need of the growing CVD epidemic. The American Society for Preventive Cardiology (ASPC) recently outlined key concepts that define the field of preventive cardiology, such as shifting to primordial prevention, improving screening of risk factors at community and national levels, and collaborating with both health care colleagues and policymakers to enact change and adopt new policies.<sup>3</sup> Incorporating some of the key concepts proposed by the ASPC, as well as focusing on unique needs for young adults regarding risk factors and lifestyle interventions in pediatric and adult cardiology training, can help standardize education and improve outcomes.

In addition to collaboration across societal programs and incorporating concepts proposed by ASPC, addressing this need requires more combined programs that specifically focus on preventive cardiology. By fostering collaboration between pediatric and adult cardiology training programs and integrating the expertise of medicine-pediatric cardiologists, we can prepare a competent and skilled health care workforce capable of tackling the challenges posed by CVD in young populations. Through collective efforts and strategic planning, we can create standardized guidelines, bridge the gap, and establish a robust framework for preventive cardiology.

## CONCLUSIONS

Current trends in rising CVD risk profiles, despite increased awareness, are cause for significant concern. Although training documents emphasize the need for CVD prevention across different age groups, the lack of specific competencies, standardized guidelines, and risk assessment tools for children and young adults highlights the urgency for a renewed approach to address the needs of this often-overlooked population. Strong collaboration is needed between societal and training programs to ensure comprehensive training and standardized guidelines that equip future cardiologists and pri-

mary care providers with skills to treat young patients and contribute to the long-term reduction of CVD.

## FUNDING SUPPORT AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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**KEY WORDS** adolescents, cardiology training, children, primary prevention, societal training programs