

CONSENSUS DOCUMENT



Cardiovascular Prevention in Children, Adolescents, and Young Adults. A Call-to-Action of the Italian Societies of Pediatrics (SIP), Hypertension (SIIA), Study of Atherosclerosis (SISA), and Cardiovascular Prevention (SIPREC)

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Abstract

Cardiovascular and cerebrovascular diseases (CVDs), primarily driven by atherosclerosis, remain the leading cause of mortality worldwide and represent a major healthcare burden. Mounting evidence demonstrates that atherosclerotic processes begin in childhood, with lipid streaks detectable as early as the first decade of life. The increasing prevalence of obesity, hypertension, dyslipidemia, insulin resistance, and other modifiable cardiovascular risk factors (CVRFs) in children and adolescents highlights the urgent need for prevention strategies starting early in life. This document, jointly produced by the Italian Society of Pediatrics (SIP), the Italian Society of Hypertension (SIIA), the Italian Society for the Study of Atherosclerosis (SISA), and the Italian Society for Cardiovascular Prevention (SIPREC), emphasizes that atherosclerosis should be considered a disease with its roots in childhood and that true primary prevention must begin from pregnancy and birth. Two possible and complementary levels of intervention should be considered: (1) population-wide promotion of healthy diets, lifestyles, and supportive environments; and (2) early identification and management of specific CVRFs in children and adolescents. The involvement of multiple stakeholders—families, pediatricians, schools, healthcare professionals, policymakers, patient associations, and the media—is crucial to ensure the effectiveness of prevention interventions. Particular attention must be given to obesity, as both an independent risk factor and a driver of additional metabolic and vascular risks. Fighting CVDs requires a paradigm shift: preventive action must start early, be comprehensive, and mobilize all sectors of society. Only by addressing cardiovascular risk during childhood can the future burden of CVDs be effectively reduced.

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Graphical Abstract new



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1 Introduction

Cardiovascular and cerebrovascular diseases (CVDs) are the main causes of death worldwide, and recognize atherosclerosis as their common denominator [1]. It is therefore clear that the prevention of CVDs based on atherosclerosis should be at the forefront of any action aimed at reducing mortality, disability and health expenditure in our country [2, 3]. The vascular alterations that characterize atherosclerosis begin very early and may already be present in the first decade of life. The speed at which this process develops is proportional to the presence of risk factors, that are already present in childhood and adolescence. In this context, the risk of an increase in CVDs in the coming years is becoming a major social and health problem, particularly in view of the epidemic of obesity (OB) affecting children and adolescents.

Overweight (OW) and OB are escalating globally, in part due to poor nutrition, unhealthy dietary practices and inadequate early life interventions. The OB epidemic seems an unstoppable trend threatening the cardiovascular (CV) and, generally, health and life expectancy also of our children [4]. This issue represents a major and complex challenge. However, a growing body of evidence and experience is indicating new solutions that could work. Unhealthy diets and lifestyles are key factors in the development of obesity and cardiovascular risk factors (CVRFs). Therefore, targeted interventions to reduce excess weight and correct unhealthy lifestyles and eating habits from childhood onwards are fundamental to preventing CV disease in adulthood [5]. Therefore, it is mandatory to act to ensure healthier diets and lifestyles for children and adolescents. True primary prevention should begin as early as possible—ideally from pregnancy [6] and birth, in order to counteract the various epigenetic influences that, throughout the course

of life, can favor the development of CVDs. This approach should target the entire population, promoting healthy diets and lifestyles from the earliest stages of life. At the same time, another key strategy is the early identification and management of modifiable CVRFs in children and adolescents. For the greatest likelihood of success, these two preventive approaches should be implemented synergistically.

The aims of the present document are to raise awareness among all doctors and healthcare personnel who deal with CV prevention. This document was produced by an inter-society working group, the “Consulta Intersocietaria Cardio Prevenzione Pediatrica e Adolescenziale” (CIKAPPA). The scientific societies involved in this project are the Italian Society of Pediatrics (SIP), the Italian Society of Hypertension (SIIA), the Italian Society for the Study of Atherosclerosis (SISA), and the Italian Society for Cardiovascular Prevention (SIPREC). However, we believe in partnership and collaboration with other medical and social figures. Therefore, the document should also be shared with other medical societies and to all healthcare professionals who deal with children, adolescents, and young adults. Since effective prevention requires not only medical interventions, but also action on the environment and lifestyles, it is essential to involve political decision-makers at every level, in addition to the educational institutions and the mass media. Fundamental for this action to have the desired effects will be the involvement of families, and patient organizations. The document should therefore be a stimulus for the entire social structure to support even small but sustainable changes in the lives of our young. For this purpose, the document proposes a series of actions to address each aspect of the problem.

2 Cardiovascular Risk Factors and Risk Behaviors in Children, Adolescents, and Young Adults

2.1 Risk Factors of the First 1000 Days

The increased awareness of epigenetics i.e. the idea that the environment can modify phenotypic expression without altering the DNA sequence, and that the early stages of life are more prone to epigenetic modifications, has profound implications for the prevention of non-communicable diseases. These concepts place new responsibilities on pediatricians: although they provide the theoretical basis for the prevention, they must also encourage reflection on the future cost-benefit implications of their treatments. The greatest influence of epigenetic factors occurs during the first thousand days. Having parents healthy, young, not overweight, non-smokers, who exercise and do not consume alcohol or

drugs is certainly beneficial for the child’s health inheritance [7, 8]. After birth, nutritional, metabolic, and environmental factors contribute to the lifelong programming of cardiovascular health [9]. Low birth weight children often develop a “thrifty phenotype”, characterized by insulin resistance (IR) [10]. For these infants, a calorie intake aimed at promoting rapid weight gain after birth creates conditions conducive to the development of excess of weight, hypertension, dyslipidemia and glucose intolerance. In very low birth weight infants, rapid weight gain is essential, but for infants who are not very low in weight, nutritional intervention aimed at more gradual weight gain should be recommended to avoid future metabolic problems. Vaginal birth and skin-to-skin contact between mother and newborn in the first hours of life should be encouraged, to promote the formation of an appropriate intestinal microbiota [11, 12]. Cautious use of antibiotics is also advisable, since early and repeated exposure may influence the microbiota composition, increasing the risk of pediatric OB and metabolic derangement [13]. Exclusive breastfeeding is recommended for up to six months [14]. Breast milk provides adequate nutrients, natural immune defenses, other important bioactive factors and the correct formation of the microbiota [14, 15]. Continuing breastfeeding during weaning [16] and breastfeeding for longer have been associated with a more correct increase in body mass index (BMI) [15]. Weaning should begin at six months, as starting earlier increases the risk of OB [17]. Introducing a variety of foods, including fruit and vegetables, promotes dietary diversity and supports healthy growth [18]. Excessive protein and simple sugar intake are associated with a higher BMI [19]. The Mediterranean Diet is the model that parents should offer their children from an early age.

2.2 Obesity

OW and OB represent major health concerns due to their widespread prevalence.

According to data from the World Health Organization (WHO), in 2022 more than 390 million individuals aged 5 to 19 years were classified as OW globally, with OB affecting 8% (approximately 160 million). Among children younger than 5 years, an estimated 37 million were OW, with a marked increase observed in low- and middle-income countries [20]. Among the European countries, Italy reports one of the highest rates of childhood OW and OB: 19% of children are OW, 9.8% are OB, showing a marked increase from the northern to the southern regions of the country [21].

BMI is the standard tool for identifying OW and OB in pediatric populations. WHO, Centers for Disease Control and Prevention (CDC), or International Obesity Task Force

(IOTF) charts are the most widely employed for the classification [22]. OW is defined as a BMI at or above the 85th percentile and below the 95th percentile, OB at or above the 95th percentile for age and sex. BMI has some limitations as it does not directly measure body composition and fat content and does not consider differences among racial and ethnic groups [5]. To overcome these limitations The Edmonton Obesity Staging System for Pediatrics (EOSS-P) has been proposed to categorize children with OB according to severity of related comorbidities and factors that can affect pediatric weight management [23]. It is a clinical staging system that is based on the validated adult version (EOSS).

Childhood OB significantly elevates the likelihood of adult OB—by approximately five times—and is closely linked to the development of CVDs later in life [24]. Notably, rapid and early weight gain during infancy is a strong predictor of subsequent metabolic dysfunction [25], but also the pattern of fat distribution plays a pivotal role. Among the various OB phenotypes, visceral fat accumulation is more strongly correlated with metabolic complications. Traditionally, BMI has been the most common anthropometric indicator to define overweight and obesity in children. However, BMI does not differentiate between fat and lean mass and do not indicate the distribution of adipose tissue. Therefore, waist circumference had gained attention as more reliable indicator of central adiposity and cardio-metabolic risk [26]. Alternatively, the waist-to-height ratio (WtHR) has emerged as a potentially superior marker for CV risk in children, given its independence from age-based thresholds [27]. Unlike BMI, WtHR remains consistent

across age and sex and has demonstrated stronger associations with markers such as insulin resistance, elevated blood pressure (BP), and dyslipidemia. A WtHR threshold of 0.5 has been proposed as a simple and practical cut-off, suggesting that maintaining waist circumference less than half of one's height may help identify children at higher cardio-metabolic risk, regardless of age or pubertal stage [27, 28].

Excess weight in childhood is tightly connected to a constellation of metabolic abnormalities, including insulin resistance (IR), impaired glucose regulation, dyslipidemia, and elevated BP [26, 29]. Each complication will be discussed in dedicated chapters.

2.3 Hypertension

Hypertension is an important determinant of CV risk both in childhood and adolescence. As for adults, in order to get reliable measurements, and accurate diagnosis of elevated BP values or hypertension, BP should be detected both in office and out of office, with a validated device, and a cuff of appropriate size. Children or adolescents are defined as hypertensive when their systolic and/or diastolic BP values are equal to or greater than the 95th percentile according to sex, height, and age. As shown in Table 1, there are some differences between the various guidelines with regard to the reference tables to use, at which age to introduce fixed cut-offs for diagnosing pediatric hypertension, or which cut-offs to adopt [30–32].

A recent meta-analysis including 271 studies from 48 countries revealed that the prevalence of hypertension in children and adolescents is around 4%, making it one of the main non-communicable diseases in this age group [33]. Furthermore, the notion that hypertension in children is essentially secondary must be dispelled [34]. Specifically, in recent decades, OB has become increasingly prevalent among children. This epidemic has been accompanied by an increase in the prevalence of childhood hypertension in both low- and middle-income countries [35]. This new evidence suggests that primary hypertension should be considered the main cause of hypertension in children, as opposed to other potential causes such as secondary hypertension.

There are several reasons why it is important to measure BP from childhood onwards. The finding of elevated BP values in a child or adolescent implies an early establishment of adverse metabolic and hemodynamic alteration, together with significant endothelial impairment, and predisposes to the development of adult hypertension [36]. Moreover, the presence of pediatric hypertension is associated with an increased risk of CV events, premature death [37], as well as early organ damage, particularly to the heart and blood vessels [38].

Table 1 Criteria for hypertension definition according to the American Academy of Pediatrics (AAP), European Society of Hypertension (ESH), and European Society of Cardiology (ESC)

Definition of hypertension	age < 13 ys	age ≥ 13 ys and age < 16 ys	age ≥ 16 ys
AAP	Systolic and/or diastolic BP ≥ 95th percentile*	Systolic BP ≥ 130 mm Hg and/or diastolic BP ≥ 80 mm Hg	Systolic BP ≥ 130 mm Hg and/or diastolic BP ≥ 80 mm Hg
ESH	Systolic and/or diastolic BP ≥ 95th percentile**	Systolic and/or diastolic BP ≥ 95th percentile**	Systolic BP ≥ 140 mm Hg and/or diastolic BP ≥ 90 mm Hg
ESC	Systolic and/or diastolic BP ≥ 95th percentile*	Systolic and/or diastolic BP ≥ 95th percentile*	Systolic BP ≥ 130 mm Hg and/or diastolic BP ≥ 85 mm Hg

* reference nomograms are obtained from a population of normal-weight individuals

** reference nomograms are obtained from a population that included individuals with excess weight

An important fact is the strong link between excess weight and elevated BP: an OW child or adolescent is more than twice as likely to be diagnosed with hypertension as a normal-weight peer (6.8% vs. 2.6%). In the presence of OB, this ratio increases to over six times higher (16.4% vs. 2.6%) [33]. Of note, the prevalence of pediatric hypertension has increased in recent decades in parallel with the increase in excess weight [4], and this trend is also evident in developing countries due to the adoption of unhealthy eating habits and lifestyles [39].

There are several mechanisms linking OB in children and adolescents to the development of hypertension. Waist circumference improves the ability of BMI to identify hypertension in obese children and is related to absolute BP values in all weight classes [40]. Excess of adipose tissue leads to an increase of sympathetic nervous system and renin-angiotensin-aldosterone system activity, and IR. Moreover, OB triggers a state of chronic low-grade inflammation and oxidative stress, causing endothelial dysfunction and increased arterial stiffness, while high level of leptin that promote sympathetic activation too, and reduced adiponectin impairs vasodilation properties [41, 42].

Isolated systolic hypertension is a peculiar hypertensive condition that affects young individuals, especially those who are active in sports. In these young people it could be due to enhanced elasticity of the arteries, with incident and reflected waves superimposing at peripheral sites, leading to spurious high peripheral systolic BP, while central BP remains low. To discriminate between this condition and true hypertension, physicians should consider out-of-office BP measurements, CV risk profiles, organ damage and central BP [43].

2.4 Dyslipidemias

Among CVRFs, dyslipidemia plays a critical role [44]. Elevated lipid levels during childhood and adolescents are strongly associated with the development and progression of atherosclerosis, predisposing individuals to major CV events later in life [45]. Lipid abnormalities tend to track from childhood into adulthood, meaning that a child with

high low density lipoprotein (LDL) cholesterol is likely to remain hyperlipidemic as an adult, thereby substantially increasing their lifetime risk for CVD [46]. This evidence highlights the importance of recognizing and managing this risk factor from a young age.

Dyslipidemia in the pediatric population can arise from various causes. Primary dyslipidemia arises from genetic disorders that affect lipid metabolism, such as familial hypercholesterolemia (FH). FH is an autosomal co-dominant disorder causing markedly elevated LDL cholesterol from birth and leading to premature atherosclerosis if untreated. Heterozygous FH affects about 1 in 250 people, while the homozygous form is rarer and more severe [47, 48]. Secondary dyslipidemia arises from underlying diseases such as diabetes, hypothyroidism, liver or kidney failure, and OB, as well as from certain medications or unhealthy lifestyle habits like poor diet, excessive alcohol intake, and physical inactivity [49].

Current guidelines classify total cholesterol ≥ 200 mg/dL, LDL cholesterol ≥ 130 mg/dL, high-density lipoprotein cholesterol (HDL-C) < 40 mg/dL, and triglycerides ≥ 130 mg/dL or ≥ 100 mg/dL (for < 9 years old or between 10 and 19 years old, respectively) as abnormal (Table 2) [50]. Epidemiological data reveal that about 15% of children aged 6–11 years and 25% of adolescents aged 12–19 years demonstrate at least one abnormal lipid parameter, with prevalence rising to nearly 40% among obese youth [51–54].

Given the early onset and progressive nature of atherosclerosis, there is a strong consensus among experts regarding the importance of early screening for lipid disorders. Current U.S. guidelines recommend universal lipid screening between ages 9–11 years and again between 17–21 years, with earlier screening in children with a family history of premature atherosclerotic CVD or known genetic disorders [50]. No such recommendations have been given in Italy. Both nonpharmacological interventions, such as diet and physical activity (PA) optimization, and pharmacological therapies, when necessary, form the backbone of management strategies aimed at improving lipid profiles and reducing long-term CV risk.

2.5 Insulin Resistance, Prediabetes and Type 2 Diabetes Mellitus

OW and OB are strongly associated with a cluster of metabolic risk factors, such as IR, pre-diabetes (pre-DM) and type 2 diabetes mellitus (T2DM) [29, 55].

IR reflects a reduced sensitivity of peripheral tissues to insulin, resulting in impaired glucose uptake and utilization. It is a common finding in excess weight population and is primarily driven by the accumulation of visceral adipose tissue. Visceral fat is metabolically active, contributing to

Table 2 Reference values for plasma lipids [50]

	Acceptable mg/dL	Border line mg/dL	High mg/dL	Low mg/dL
Total cholesterol	<170	170–199	>200	
LDL cholesterol	<110	110–129	>130	
Triglycerides < 9 years	<75	75–99	>100	
Triglycerides >10 years	<90	90–129	>130	
HDL cholesterol	>45	40–45		<40
Lp(a)	<30	30–50	>50	

systemic low-grade inflammation and to IR. As a consequence, a chronic state of hyperinsulinemia leads to glucose intolerance and mainly to T2DM [56, 57].

The assessment of IR in childhood remains controversial. Transient, physiological IR occurs during puberty, and IR degree vary widely across age, sex, and ethnic groups [29]. Several IR indexes mainly based on fasting glucose and insulin have been proposed in literature [57].

Considering all the three phenotypes of prediabetes (pre-DM: impaired fasting glucose, impaired glucose tolerance, and glycosylated hemoglobin (HbA1c) between 5.7 and 6.4%), the prevalence of pre-DM in OB children/adolescents is on average 17%. The heterogeneity is very high, even in cohorts with similar ethnic composition, with a prevalence ranging from 3–56% [58]. The risk of pre-DM is almost three times higher in youth with OB compared to healthy youth, and it also correlates positively with the BMI [58]. In a recent Italian study, pre-DM was detected in 22.8% of OW/OB children under 10 years of age [59].

The prevalence of T2DM has increased over time, and current data suggest that T2DM accounts for 20–33% of new diabetes diagnoses in the pediatric age [29]. T2DM has a prevalence of 1.3% [60]. Some ethnicities (Native Americans, Africans, Latinos, Asians, and Pacific Islanders) are at increased risk, compared to White youth [60].

As prediabetic conditions are associated with progression to T2DM and increased CV risk [55, 61, 62], the treatment of pre-DM is fundamental to preserve the capacity for insulin synthesis and secretion [56]. Therefore, in children/adolescents with preDM, all guidelines recommend a healthy lifestyle. DM2 is treated with lifestyle plus drug therapy [60]. In 90% of cases, the patients on metformin + insulin therapy can be weaned off insulin in 2–6 weeks. If HbA1c does not decrease below 7%, a glucagonlike peptide-1 agonist licensed for use in children can be added to metformin [60]. Patients keeping a high HbA1c (>9%) need s.c. insulin besides maximal doses of metformin and glucagon-like peptide 1 agonist /other medication [62, 63]. HbA1c should be assessed every three months. Retinopathy and albuminuria should be screened at diagnosis and annually [63, 64].

2.6 Hyperuricemia

The increase in serum uric acid (SUA) can be due to increased synthesis or decreased excretion of UA. Moreover, the consumption of simple sugars, particularly fructose, stimulates the production of UA. Excess fructose intake occurs in children through sugary drinks with high fructose syrups and leads to other metabolic disorders, such as increased production of triglycerides, very low density lipoprotein cholesterol, and fatty liver through *de novo* lipogenesis [65].

In adults, elevated SUA levels are a recognized independent risk factor for mortality and arterial hypertension [66] and are strongly associated with a greater risk of CVD and all-cause mortality in people with coronary artery disease [67]. In pediatric age, several studies have demonstrated a direct relationship between SUA and BP values [68, 69]. Two randomized controlled trials showed that the reduction of SUA levels by allopurinol or probenecid led to the normalization of BP in adolescents with high BP. This finding confirms the causal role of UA in pediatric hypertension [70, 71]. Furthermore, dietary-behavioral intervention is less effective in reducing BP in hypertensive children with high UA values [72].

2.7 Tobacco Smoke

Tobacco exposure, both active and secondhand, significantly increases the risk of CVDs like coronary heart disease and stroke by raising BP and heart rate, while also promoting atherosclerosis [73]. Epidemiological, observational, and experimental evidence demonstrates the detrimental CV consequence of secondhand tobacco smoke exposure in children. There are many mechanisms through which passive smoking exerts its harmful effects, including the activation of inflammatory processes, endothelial dysfunction, increase in vascular stiffness, and autonomic dysfunction. In addition, exposure to secondhand tobacco smoke in childhood is associated with the clustering of cardiometabolic risk factors, such as obesity, dyslipidemia, and IR [74]. Furthermore, the Cardiovascular Risk in Young Finns Study revealed that children of smokers are at an increased risk of developing carotid atherosclerotic plaque in adulthood [75].

High taxation of tobacco products and strict regulation on e-cigarettes are known to be important contributors to reduced consumption of tobacco products [76]. However, it is essential to increase awareness among middle and high school students about the health risks of smoking, the benefits of quitting, and the available methods (such as counseling and pharmacological treatments) to achieve this goal [77–79]. There are multiple reasons to quit smoking, including health, economic, and aesthetic factors (such as bad breath, unpleasant odor, yellowing of fingers, and changes in skin color), as well as issues related to self-esteem and dependence. Quitting smoking is difficult but not impossible, and there are multiple methods available to support cessation, including counseling from friends or one's general practitioner, as well as pharmacological treatments [78]. Peers play a crucial role during adolescence, exerting both positive and negative influences. Communicating preventive messages—focused on healthy lifestyles and the social value of prevention—in an interactive manner and

using language that resonates with students can significantly enhance engagement and improve preventive outcomes.

2.8 Alcohol

Alcohol can cause irreversible brain damage in children and adolescents. Early initiation of alcohol use is linked to a higher likelihood of accidents, risky sexual behaviors, unintended pregnancies, and, in the long term, poorer educational and social outcomes [80, 81]. Early alcohol consumption is associated with alcohol use disorders in adulthood [82]. In adulthood, alcohol is associated with several serious diseases such as dementia, liver disease, pancreatitis, various types of cancer, but also, relevant to the topic of this document, CVD and T2DM. Some studies suggested that the relationship between alcohol and these pathologies follow a J-shaped curve, with moderate consumption associated to protective effects [83]. However, a meta-analysis of 56 Mendelian randomization studies reached a different conclusion [84], showing that even moderate drinkers would have a cardiovascular health benefit by eliminating alcohol consumption. It must be remembered that the alcohol-dehydrogenase enzyme, the main responsible for alcohol detoxification, is physiologically deficient up to 18-20 years of age. Therefore, the effects of alcohol are greater in children, and last longer.

2.9 Diet, Junk Food, Ultra-Processed Food

A proper diet is essential for good health. This is even more true for children, who may be exposed to early dietary errors for a long time, with bad habits being more difficult to change. Parents who follow a varied and balanced diet and maintain healthy eating habits help protect their children from developing wrong attitudes towards food, such as repetitiveness, selectivity, fussiness, or excessive gluttony.

The Mediterranean Diet is the paradigm of a healthy diet [85]. Unfortunately, the current dietary habits of youths are far removed from the Mediterranean Diet, not only because traditional foods are consumed in the wrong quantities and proportions, but also because of the massive introduction of junk food (JF) and ultra-processed (UPF). These two terms are not synonymous. JF is made from low quality, cheap, nutritionally unbalanced ingredients that are high in calories, salt, sugars and saturated or hydrogenated fats. UPF (packaged baked goods and snacks, fizzy drinks, sugary cereals, processed meats, ready meals) undergo multiple industrial processes and often contain colors, emulsifiers, flavorings, and other additives [86]. They also tend to be high in added sugar, fat and/or salt, often low in vitamins and fiber. UPF are exclusively industrially produced. The food industry is able to change the taste, aroma, texture, in

a word, the palatability of a food. The aim of ultra-processing is to create foods with an elemental taste and texture that can be consumed in large quantities in a short time, until the consumer becomes almost addicted. These characteristics in themselves are conducive to OB. In addition, repeated consumption of UPF and JF can lead to excessive intakes of salt, sugar and saturated fat, and deficiencies in fiber, vitamins, and other micronutrients. In addition to OB, many studies have linked JF consumption to major non-communicable diseases [87, 88]. There are concerns about the consequences of ultra-processing if consumed on a large scale over a long time. These findings suggest using population-based and public health measures to target and reduce dietary exposure to UPF.

Particular attention should be paid to children, as they are particularly exposed to adverse effects due to their reduced body mass with respect to a toxic agent. Today, it is estimated that in the U.S. about 60% of the calories consumed by children come from UPF or JF [89], in Italy this share is around 25% [90]. In addition to the recent introduction of these products, there is a progressive change in the times and ways of consuming food. There is a tendency to consume food quickly, without a dedicated space for eating, using ready-made or minimally prepared foods that can be eaten at any time of the day. Children in particular need adequate space and time to eat, where they can learn good eating habits and appreciate the taste of healthy food. This development begins in the family, but must continue in the enjoyment of sharing meals with peers.

2.10 Television and Video Games

Many children and adolescents spend a significant part of their day in front of a screen, with access to various devices such as televisions, PCs, consoles, tablets, and smartphones. The consequences can be manifold, ranging from visual problems to behavioral and psychosocial development disorders [91, 92]. There are two mechanisms through which the link between watching television and OB is mediated: time spent watching television, which takes away from other, less sedentary activities, and children's television programs showing a lot of advertisements for JF, which is eaten watching television. Children should be protected from television advertising, particularly those who do not understand its commercial purpose. However, some studies [93] have found a relationship between time spent watching television and OW/OB, but others [94] have not. The correlation between watching television and OB is probably only true for exposure of many hours, well beyond the two hours per day considered acceptable [95]. Screen time is positively associated with cardiometabolic and CV risk, particularly in children and adolescents with shorter sleep duration [96].

Video games have a more recent history than television. The first one was introduced around sixty years ago. Since then, they have become much more complex and realistic, and their diverse features have made them more popular than television among young people. The video game market is huge, and technology is advancing very quickly. Several studies have considered time spent watching television and playing video games together, but no clear data has emerged [97]. Although the two activities are similar, they are not interchangeable. However, it cannot be ruled out that players consume JF during gaming sessions, although this could be difficult for the commitment to the video game. Some video games have been shown to increase heart rate, BP, sympathetic activity and mental stress, and probably calorie consumption [98].

The stimulating effects of video games raise questions about their potential negative impact on the CV health of individuals who play them for extended periods. Studies focusing solely on video games have not conclusively confirmed an association with excess weight in children and adolescents. [99]. On the other hand, it should be noted that video games could potentially be used for CV prevention. For example, exergames involve performing PA in front of the screen by simulating sports games [100]. Furthermore, video games could be designed to offer educational content. In conclusion, both the American Academy of Pediatrics and the Italian Pediatric Society provide parents with precise guidelines regarding their children's exposure to television, video games, and smartphones. The use of these devices is completely discouraged for younger children, while older children are permitted to use them for up to two hours per day [101, 102].

2.11 Sleep Disorders

The duration and quality of sleep are important for children and adolescents. Furthermore, sleep-disordered breathing, the most common form of which is obstructive sleep apnea syndrome (OSAS), is frequent at this age [103, 104]. The etiology of childhood OSAs is multifactorial and involves many risk factors. These factors can increase the narrowing and collapsibility of the upper airway, thereby contributing to the pathogenesis of OSAs, including both anatomical and neuromuscular disturbances. The most common risk factor is adeno-tonsillar hypertrophy. In addition to anatomical factors, OB has also been identified as a contributing factor to OSA [105]. A negative association between sleep duration and BP has been described. A meta-analysis by Jiang et al. [106] reported that short sleep duration was significantly associated with an increased risk of high BP. A significantly elevated systolic BP associated with sleep-disordered breathing was observed in a population of U.S.

children [107], and a recent study indicated that the presence of OSAs in childhood was associated with an approximately threefold increased risk of high BP in adolescence [108].

The relationship between sleep duration and OB is well established. Two meta-analyses revealed a significant correlation between children's sleep duration and OB [109, 110]. Furthermore, a longitudinal association has been documented between children short sleep and OB [111].

Several studies have shown an association between OB and an increased risk of OSAs in children and adolescents [112, 113]. The association between sleep disorders and metabolic alterations is less clear. Further evidence is required to confirm the relationship between sleep duration and quality, lipids and glycemic profile [114, 115].

Increased oxidative stress, endothelial dysfunction and systemic inflammation have been described in children suffering from OSAs [116].

The first-line treatment for OSAs in children is surgical removal of the adenoids and tonsils when adeno-tonsillar hypertrophy is present, or continuous positive airway pressure in children with craniofacial abnormalities or neuromuscular disorders [105]. For children with OB and OSAs, the primary therapeutic objective should be weight loss, as this has been shown to significantly reduce the number of apneas [117].

2.12 Pollution and Climate Change

In recent decades, a number of factors have changed the environment in which we live. It has therefore become increasingly important to understand what can be, beyond the positive aspects, the negative influences of the environment on the state of health based on the concept of "One Health". Climate changes and environmental diffusion of toxic substances alter the environment and living organisms, even interacting with each other and enhancing themselves [118]. There are times in life when there is a particular sensitivity to the toxic effects of pollutants. Current research lines are based on prospective data, seeking to assess the so-called exposome, which also includes psycho-social components and socio-economic conditions [119].

There is general agreement that subjects of developing age show, compared to adults, a higher sensitivity to toxic effects and in particular are at greater risk during fetal life and the first years of post-natal life. During fetal life, toxic agents cross the placental barrier and interfere both on the morphogenesis of the fetus and on the "programming" mechanisms that make it more prone to develop pathologies in later stages of life. For these reasons most studies in the developing age have concentrated in the early period of life, but also in later periods, up to adolescence, there is greater sensitivity to toxic effects than in adults.

As we know, OW and OB are a multifactorial condition due to the interaction of genetic, nutritional and lifestyle factors. In recent years, people have begun to consider the environment as a factor involved in weight accumulation pathogenesis. A particular focus of the studies was the potential link between air pollution (AP) and weight gain in children and adolescents. In the last four years there have been several systematic reviews and meta-analyses on this subject, which have made it possible to clarify the relationship between AP and accumulation of weight [120–122]. In particular, the levels of fine dust and other pollutants such as NO_x and NO₂ were evaluated, which are a significant component of urban pollution and compared with the weight of children and adolescents living in those areas. All studies [121–123] have shown that high levels of fine dust are associated with a significant increase in the risk of childhood OB, with a time-dependent relationship.

Various pathogenic mechanisms explain the relationship between pollution and hypertension. It has been shown that AP-induced respiratory phlogosis causes the blood to carry inflammatory mediators which cause oxidative stress and endothelial dysfunction, that the particulates cause an imbalance of the autonomic nervous system with activation of the sympathetic system, reduction of parasympathetic tone and that epigenetic mechanisms due to exogenous chemicals promote the onset of hypertension. There are still few clinical studies that consider the relationship between environment and hypertension in developing age, but a recent meta-analysis confirms the existence of a relationship between AP and hypertension in adolescence [124].

3 The Protagonists of the Intervention and Their Roles

3.1 Family Physicians and Pediatricians

The Italian health system provides for children up to the age of 14/16 to be cared for by a Primary care pediatrician (PCP) [125]. The PCP not only treats intercurrent pathologies, but also carries out planned checks on the child's physical growth and psychological development. He or she also knows the family, whose medical history often extends to the grandparents. The PCP prevention thus has important resources for early CVP that are not always fully exploited. The PCP promotes health through age-appropriate interventions, by encouraging breastfeeding and correct weaning in line with the introduction of the Mediterranean Diet, stimulating PA and discouraging sedentary behavior. It should counteract the risky behaviors of adolescence, i.e. smoking and alcohol consumption. Finally, the PCP should carry out BMI monitoring to prevent OB [126, 127]. These activities

are important for CV health, but they may not be enough for children at greater risk, because of a family history of CVD or diabetes, or the presence of risk factors such as hypertension, dyslipidemia, IR, or hyperuricemia. These conditions are often, but not exclusively, present in children/adolescents with OB. The PCP may treat at-risk individuals with an almost exclusively dietary/behavioral approach or refer them to second-level centers [128]. After the age of 14, young people come under the care of the general practitioner, who will no longer carry out regular check-ups, but will only see young patients when an illness arises, which is not frequent at this age. Consequently, young people who had been identified as having a CV risk profile could lose the continuity of care provided by their previous referring doctor. To overcome this difficulty, it would be advisable to develop a referral form for transferring all adolescents from the pediatrician to the family doctor. This would be particularly necessary in the case of young people at CV risk.

3.2 Secondary Care Centers

Secondary care centers play a critical role in the early identification, evaluation, and management of CVRFs in children and adolescents. Their specialized expertise enables timely diagnosis of complex conditions such as dyslipidemia, hypertension, OB-related metabolic syndrome, and early-onset T2DM. Beyond diagnostic accuracy, these centers ensure the implementation of individualized care plans and facilitate access to multidisciplinary interventions, including nutritional counseling, lifestyle management, and pharmacological therapy when needed [129–131]. Moreover, an essential function is to connect and coordinate with PCPs, ensuring a seamless continuum of care.

A notable example of an effective model is the LIPIGEN project, promoted by SISA (<https://lipigen.sisa.it/index.php>) [132], a national network linking clinical centers and molecular labs for the diagnosis and management of genetic lipid disorders. By using shared diagnostic protocols, LIPIGEN has greatly improved the detection and care of hereditary dyslipidemias, including in children and adolescents.

3.3 The Family

According to the United Nations' Convention on the Rights of the Child, every child has the right to grow up in a healthy environment [133]. However, children often grow up in unhealthy familial environments, above all in those families with an education and economic gap, that promote the development of OB adopting obesogenic diets (buying cheap, calorie dense, nutrient-poor, hyper-palatable foods) [134, 135]. Families often choose and buy foods depending on factors such as personal preferences, but also economic

and socio-cultural-education level. Moreover, even in the Mediterranean countries, the globalization is bringing to the adoption of “Westernized” dietary models rich in UPF, while the Mediterranean Diet adhesion is declining [136, 137]. Therefore, also in Southern Europe it is mandatory to recover and promote traditional dietary habits of Mediterranean countries, and it is essential to promote greater awareness [138].

If the strategy could start from educate the parents to buy healthy foods, front of pack nutrition labelling has an important role: it should support an informed, aware, and healthier food purchase. To reach this goal, it should be easy to read and to understand independently of the consumer’s cultural level [139]. Moreover, because the parents and teen-agers may find portions expressed in grams of product incomprehensible, important would be to express the portions in product units with information on calories per unit. All these actions, accompanied by an educational campaign, could be a crucial measure to promote healthier food choices by families.

Because the words “sport” and “gym” sometime could accompany images that can trigger negative associations for many children as competition, medals, fatigue, the parents should encourage their children to participate in PA, offering emotional support and positive endorsement about fun and well-being. Moreover, the parents could play PA together with their children, even just accompanying them to school on foot or by bike or doing PA together with their children or in parallel with them, with additional benefits.

3.4 The School

The increase in OW and OB is not simply about children or families making “bad choices”, but it is far more complex and may also depend on factors including the education and training each child or adolescent receives [133]. Even at school, the young students often grow up also in unhealthy school environments that promote the development of OB, mostly adopting obesogenic diets based on cheap, calorie dense, nutrient-poor, hyper-palatable foods, and unhealthy lifestyle as smoking [140]. In this context, young people from disadvantaged communities are more likely to experience health inequalities and educational disadvantage. However, because health literacy is a determinant of health, the schools are the ideal setting for health promotion and health literacy interventions and reduce health inequalities among students. Therefore, an alliance with high school directors, teachers, and catering managers can produce simple and feasible strategies [141], for example, to replace the traditional vending machines with those stocked with medium to small portion sizes and low-fat, low-sugar, low-salt and low-calorie ‘healthy’ options. And in cases where

the vending machines were not located in the school, the objective should be to regulate and improve the nutritional quality of food and beverages served in the cafeterias and school canteens with the reformulation of the offer [142].

Moreover, the schools can play a role also in increasing the PA of their students, because the inclusion of sport in the daily routine of the student can be a habit that when acquired during the school years will be easier to maintain in adulthood. The initiatives in the schools need to be reinforced through seminars and training sessions by nutrition and healthy lifestyle experts for both the students and the teachers to build their educational and communication skills on nutrition and CV prevention. Moreover, educating children and raising their awareness will help transfer the message to their parents and, in future it will help these children live healthy lifestyles when they become adults.

The Parliament can have a fundamental role by enacting legislation that regulates the nutritional quality of food and beverages of the catering system, including vending machines in public venues accessible not only to children and adolescents, but also to adults [143].

3.5 The Marketing by Mass Media

The “obesogenic” environment means also the promotion of unhealthy foods that are cheap and readily available, while healthier foods are harder to find and are often expensive. The consequence is that eating unhealthy has never been as easy as it is today. Children and adolescents have significant value to commercial actors in the advertising market because they often purchase products directly and they play a key role in influencing family buying decisions [144].

In Italy, but also in Europe, there is still no regulation of marketing aimed at children, whether through traditional media or digital platforms [145]. The most exposed are children as, in recent years, the number of teenagers on the web has increased and companies have acted in step: advertising messages mainly exploit digital channels that are even less regulated than traditional ones. Among the strategies used, there are the “on the go” consumption, multi-buy offers, limited-time offers (“only available for a short time”), toys and mascots to boost demand, use of online games, sponsorship of events and concerts, viral campaigns with product placement in videos on YouTube, often posted by peers or by influencers with millions of followers [146]. All these strategies escape regulatory laws. Therefore, there is an urgent need for stronger regulatory and legislative measures and enforcement to protect children’s health and wellbeing by not only limiting the marketing of unhealthy food, but also promoting sustainable and healthy dietary habits. To reach this goal, a national and European government plan

is needed, along with the cooperation of food and beverage companies within the framework of corporate social responsibility.

3.6 Gyms and Sport Facilities

Nutritional and PA programs should be integrated into national CV plan, providing specific recommendations tailored to different age groups [147]. However, even though it is well known that PA plays a critical role in the prevention and treatment of CVRFs, consistent participation in PA, especially for children and adolescents with study loads or belonging to families with economic hardship, is difficult to obtain and maintain [148]. Therefore, we have to work to increase children's participation in PA programs.

Parents should encourage their sons/daughters offering emotional support and positive endorsement about fun and well-being and have the possibility to do PA together with their children. The world of gyms should offer a concrete help by organizing ad hoc courses or equipping playrooms or libraries or room for homework dedicated to the children of parents who play sports. Testimonials should represent real role models showing children confident being themselves as motivational trigger rather than images of fitness and beauty that may feed feelings of inadequacy. Schools should include sport in the daily routine of the student, because a habit acquired during the school years the easier it becomes a habit in adulthood. Technology should be used for training at distance and to personal touches in communications. Since PA and sport are an investment for society, members of national Parliament should implement appropriate tax policies, including tax breaks for sports centers that activate inclusive initiatives, tax breaks/bonuses for families who register, a redevelopment of cities with safe bike lines and pedestrian areas close to schools, a legislation that can improve working hours by making them more flexible to carry out sports activities.

3.7 Politics

CV prevention is a problem that must be addressed in all its aspects, as it is not only linked to personal responsibility, but also depend on the lack of legislative protection. This protection could safeguard the health of consumers, particularly children and young people, who are vulnerable and in need of protection. It could also combat socio-economic inequalities by protecting those in lower income and/or education brackets, who often turn to JF as it is cheaper than healthy food [135].

OB and CVDs result in major financial and social burdens, impacting millions of people and stretching health-care systems and budgets. On the contrary, CV prevention

is an investment for the society [149]. We have to consider how the role of national Parliament could be crucial. In the political agenda, funds must be made available to develop programs, projects, initiatives that can support children's health [150]. A series of initiatives should be implemented by politicians:

1. to allocate funding for public information campaigns with simple and accessible language on CV prevention, by various media platforms accessible to diverse populations and settings, including schools;
2. to increase the taxes for sugary drinks and reduce the taxes for fruit and vegetables and/or give incentives to encourage their purchase and consumption;
3. to reduce the number of fast-food outlets near schools;
4. to improve the quality of the foods sold in the vending machines or school canteens;
5. to regulate the marketing of food high in fat, sugar and salt that occurs through traditional media and digital platforms;
6. to apply a simple, understandable, useful, and effective front-of-pack labelling. Something has been already done with the removal of trans fatty acids from the food supply and this is one of the most straightforward public health interventions in the European Union.

As already discussed, an adequate tax policy must also be implemented to encourage and facilitate PA, which is an investment for society. This could include the redevelopment of cities to make them more child-friendly and promote health Legislation could also be introduced to improve working hours by making them more flexible to carry out sports activities.

Furthermore, doctors can also have a political approach and should become political ambassadors of CV prevention. We must persuade hospital management to create specialist centers for prevention and treatment of CVRFs in children, adolescents, and young adults. These centers would equip healthcare professionals with multidisciplinary skills in nutrition, physiotherapy and mental health. They would tailor interventions to individual needs, ensuring that all individuals receive comprehensive, accessible and personalized care. We must work across political parties to improve CV health and child outcomes by encouraging our politicians to take action.

3.8 Patient Associations

Patient associations play a pivotal role in the prevention and management of CVRF in children and adolescents [151]. Their action extends far beyond patient support: they actively contribute to raising awareness, promoting

education, advocating for early screening, and facilitating access to multidisciplinary care. In the context of CV prevention, patient associations help in identifying at-risk populations early by organizing public health campaigns and collaborating with schools and pediatric practices. They promote healthy lifestyle choices by supporting nutrition education programs, PA initiatives, and family-centered interventions. Moreover, patient organizations advocate for better healthcare policies, pushing for structured screening programs for CVRFs and lobbying for funding dedicated to pediatric research [152]. They often collaborate with healthcare professionals to create practical guidelines tailored to the specific needs of the pediatric population, aiming for integrated, proactive, and preventive healthcare models [153].

4 Implications for Scientific Research

4.1 We Believe that Scientific Research Addressing the Issues Discussed in this Document Should Develop in Several Directions

- 1) Perform studies aimed at understanding the pathophysiology of CVDs and the mechanisms through which different risk factors lead to CV damage and overt disease in children and adolescents. A population free from confounding factors such as comorbidities, drug interactions, effects of aging, smoking and alcohol consumption can be extremely useful in providing important information on this issue.
- 2) Conduct prospective clinical studies to verify whether there is an association between CV risk factors present in childhood and adolescence, and the incidence of CV events later in life.
- 3) Design pharmacological studies in children with CVDs that requires treatment (e.g. hypertension or dyslipidemia). Clinical randomized trials of new CV drugs often exclude children and adolescents, and drugs validated in adults are used ‘off label’ in the case of early-onset CVDs in this population. Observational pharmacological studies are also limited in this age group.

5 Conclusions

Atherosclerotic CVDs are the leading cause of death worldwide. They also account for a significant proportion of healthcare expenditure. For this reason, they should be a top priority in healthcare prevention policies, because

it is likely that many children today will develop CVDs during their lifetime.

Atherosclerotic processes can begin as early as the first decade of life, and its prevention should start from childhood. In children and adolescents, risk factors may be present in either a potential (e.g. family history) or actual state. OB, high BP, dyslipidemia, IR, and hyperuricemia are not uncommon in this age group. If these risk factors are present at an early age, exposure to them will be prolonged over time.

Preventing OB is particularly important because it is a risk factor in itself and a CVRF that promotes the onset of other CVRFs. The current epidemic of excess weight among young people raises fears that, when they become adults, the incidence and prevalence of cardiovascular events will overwhelm the current welfare systems.

The only real possibility of reversing this trend is through effective early prevention. Normal weight children may also exhibit risk factors and should also be investigated. CV prevention should be implemented at two levels. Firstly, all children and adolescents should be encouraged to adopt healthy lifestyles and eating habits in a health-promoting environment. Secondly, individuals with specific CVRFs should be identified. Children and adolescents at risk should be monitored closely, possibly at secondary medical centers.

Close and collaborative working between families, school staff, healthcare professionals and politicians is essential to achieve these objectives.

Table 3 and Table 4 provide practical recommendations for each of the points discussed, outlining the steps that should be taken to ensure effective prevention measures are in place.

Table 3 Summary of actions to address the different cardiovascular risk factors in children and adolescents

Risk factor	Call to action	Section
First 1000 days	The first thousand days of life are the period during which epigenetic changes are most likely to occur, creating the conditions for the development of a phenotype that is more or less susceptible to future CV disease. This creates many opportunities for successful prevention activities and places great responsibility on those who care for pregnant women, newborns, and young children. Factors essential to planning for future health in adulthood include parental health and fitness, hygiene during pregnancy, disease prevention, type of delivery, initial contact with the mother, prolonged breastfeeding, proper weaning, and later, a Mediterranean Diet.	Section2.1
Obesity	Based on international recommendations, annual assessment of BMI should be recommended, alongside dietary nutrition and physical activity counselling for children and adolescents starting from the first years of age.	Section2.2
Hypertension	Office BP should be measured from childhood, especially in young subjects with other CVRFs, such as excess weight, metabolic alterations, being born after a complicated pregnancy (e.g. hypertension, diabetes, obesity), or family history of hypertension. The recommendation is to measure BP with a validated device and an appropriately sized cuff at least annually or in any occasion of medical visit.	Section2.3
Dyslipidemia	Routine lipid screening should be implemented for all children between ages 9–11, and earlier for those with a family history of premature CVD or known genetic disorders of lipid metabolism. Timely lifestyle counseling, and, when indicated, pharmacologic treatment should be provided to correct lipid abnormalities before they track into adulthood.	Section2.4
Insulin resistance, prediabetes and type 2 diabetes mellitus	Pediatric guidelines recommend that children with OW/OB undergo fasting glucose test and HbA1c assessment starting at 6 years of age. An Oral Glucose Tolerance Test and HbA1c should be performed in children with OW/OB from age 10 years or at pubertal onset in the presence of additional risk factors. In those with normal screening results, screening should be repeated after 3 years, or before in case of worsening BMI or strong family history of T2DM.	Section2.5
Hyperuricemia	SUA measurement should be part of the CV risk assessment also in children. Sugar-sweetened beverages and fruit juices should be eliminated from children's diets.	Section2.6
Tobacco smoke	It is important to increase the awareness of students of middle and high schools of the fact that smoking is a CVRFs, of the numerous health and economic benefits of quitting smoking, and on the methods to reach this goal. Governments should work on a high taxation of tobacco products and a strict regulation on e-cigarettes.	Section2.7
Alcohol	Although the effect of alcohol on CV risk is debated, children and adolescents should not be exposed to this toxic agent.	Section2.8
Diet, junk food, ultra-processed food	Children and adolescents must be protected from the spread of new and unhealthy eating habits, including JF and UPF, through both educational and practical initiatives. The reference model for a healthy diet is the Mediterranean Diet.	Section2.9
Television and video games	Although no precise limits have been defined, it is likely that spending excessive amounts of time in front of a screen is associated with excess of weight and other cardiovascular risk factors. To preserve children's health, particularly their mental health, Paediatric Scientific Societies advise parents to actively monitor how much time children and adolescents should spend in front of screens, in terms of both quantity and quality.	Section2.10
Sleep disorders	Poor sleep quality and duration in children and adolescents may be associated with CVD, particularly high BP. This is particularly evident in cases of sleep-disordered breathing, especially among individuals with OB. Therefore, investigating this aspect is important, as sleep disturbances may represent a significant CVRF.	Section2.11
Pollution and climate change	From a global view of current knowledge, it is clear, as stressed by all researchers, the need to deepen studies on the impact that the environment can have on CV health in childhood and adolescence. It follows that the paediatrician, as a point of reference for families, should be trained culturally on environmental issues and helped to carry out awareness and education work, and that scientific societies are spokespersons for pollution control needs.	Section2.12

BMI: body mass index; BP: blood pressure; CVRFs: cardiovascular risk factors; CVD: cardiovascular disease; HbA1c: glycated hemoglobin; OW/OB: overweight/obesity; T2DM: type 2 diabetes mellitus; SUA: serum uric acid; JF: junk food; UPF: ultra-processed food

Table 4 Summary of advised interventions from different protagonists involved in the cardiovascular health of children and adolescents

Protagonist	Call to action	Section
Family physicians and pediatricians	Pediatricians and family physicians play an important role in preventing disease and promoting health among the younger people. Therefore, it is important to expand their activities to identify children and adolescents with CVRFs.	Section 3.1
Secondary Care Centers	In order to improve care for children and adolescents at CV risk, it is crucial to expand the number of specialized second-level centers that treat the most complex cases.	Section 3.2
The family	Every child has the right to grow up in a healthy environment. However, for social, economic and cultural reasons, families are not always able to guarantee this right for their children. For example, unhealthy foods may be chosen because they are cheaper, or because parents lack knowledge about nutrition. There may also be economic barriers to engaging in PA. Economic incentives should be provided to the poorest families, and educational programs should be carried out to raise parents' awareness of the need to provide their children with healthy nutrition and encourage them to engage in PA.	Section 3.3
The school	In order to regulate and improve the nutritional quality of food and beverages served in school cafeterias, it is advisable to form an alliance with high school principals, teachers, and food service managers. In order to enact legislation that regulates the nutritional quality of food and beverages in catering systems and vending machines, it is essential to forge alliances with governments.	Section 3.4
The marketing by mass media	Alliance with politicians and food and beverage companies are warranted to regulate the marketing to children that occurs through traditional media or digital platforms, promoting sustainable and healthy dietary habits.	Section 3.5
Gyms and sport facilities	Alliances with schools to include the sport in students' daily routines are warranted, as are alliances with gym centers that could organize parallel courses for parents and their children. Playrooms, libraries and homework rooms should be equipped and dedicated to the children of parents who play sports. Alliance with the governments should promote an adequate tax policy and a redevelopment of cities.	section 3.6
Politics	Political departments that deal with health should improve children's CV health through several action as creating specialist centers for obesity and CV prevention; allocating funding for public information campaigns ; increasing taxes on sugary drinks and reducing taxes on fruits and vegetables; reducing the number of fast-food outlets near schools; improving the quality of foods sold in vending machines and school cafeterias; regulating the marketing of unhealthy foods ; and applying simple, understandable front-of-pack labeling.	Section 3.7
Patient associations	Strengthening partnerships with patient associations is essential to transform awareness into action and secure a healthier future for children at CV risk.	Section 3.7
Implications for Scientific Research	Scientific societies should increase and support clinical studies aimed at clarifying the physio-pathological and clinical and therapeutic aspects of CVDs in children and adolescents.	section 4.0

CVRFs: cardiovascular risk factors; CV: cardiovascular; CVD: cardiovascular disease, PA: physical activity

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Declarations

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Ethical Approval No request to local Ethic Committee has been made, given the descriptive nature of the manuscript. All procedures performed in clinical trials discussed in this manuscript and involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants involved in the clinical trials, according to the study protocols.

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