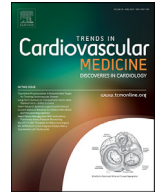




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## Editorial commentary: Early exposure, lifelong damage: Evidence of cardiac damage from childhood smoking

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### Introduction

In this issue of *Trends in Cardiovascular Medicine*, the review article by Corsi and Agbaje [1] provides up-to-date evidence of the early insults of childhood smoking on the growing heart. The study focuses specifically on the long-term effects of both direct smoking and second-hand smoke exposure on cardiac structure and function. In addition, it addresses a critical public health concern as the prevalence of smoking in childhood and adolescents is becoming a substantial public health concern, where the prevalence has been shown to increase with age, with the majority (60 %) of children continuing to smoke into their early to late adulthood [2]. Adolescents born to smoking mothers are also more likely to initiate smoking as adolescent smoking is associated with maternal tobacco use (odds ratio 2.06, 95 %CI 1.93–2.19) [3].

### Discussion

The study presents evidence of early pathophysiological changes in children who smoke tobacco. Some of the effects of cigarette smoking include the activation of the sympathetic nervous system leading to increased plasma epinephrine levels, an increase in heart rate, blood pressure, myocardial contractility and hemodynamic changes (such as increased cardiac output, vascular dysfunction and vasoconstriction) [4]. These effects are increasingly observed in both active cigarette smokers and those exposed to second-hand smoke [4]. In addition, second-hand smoke exposure is also a major public health concern, particularly in low-income communities. Although second-hand smoking exposure may be perceived as less toxic, the effects on the cardiovascular system in children renders it to be equal, if not more harmful, than direct cigarette smoking [5]. In this review, the evidence presented include an increased left ventricular mass index and interventricular septum thickness in children exposed to second-hand smoke [5]. In addition to damage to the heart, evidence suggest that the arteries sustain significant vascular damage in children and adolescents, indicated by reduced flow-mediated dilation and increased carotid intima media thickness and pulse-wave velocity [6]. These are all indicators of subclinical atherosclerosis, potentially, increasing their risk of early onset of cardiac events. This is corroborated by a study including 52 countries in which smoking was one of nine modifi-

able risk factors that accounted for 90 % of the risk of having the first myocardial infarction [7]. Therefore, preventing smoking initiations in children and adolescents can prevent premature cardiovascular pathology and, thus, significantly reduce their cardiovascular risk in adulthood.

One of the effects termed left ventricular hypertrophy occurs in response to increased hemodynamic pressure and volume where the myocardium attempts to compensate for the myocardial tissue that has become ischemic by increasing muscle volume to maintain contractile forces [8]. Simply, the heart muscle overcompensates for an increased workload, consequently increasing the risk of heart failure and dysrhythmias. Furthermore, a systematic review reported that smoking initiation was causally associated with coronary artery disease [9]. Coronary artery disease caused by atherosclerosis in the coronary arteries is one of the leading causes of death, globally. It is now evident that atherosclerosis begins quite early in childhood, which presents initially as fatty streaks that can evolve into atherosclerotic lesions [10]. Based on autopsies, a study proposed that atherogenesis develops first in the aortic artery, followed by the coronary arteries [10].

### Implications for prevention and policy

Initiation of tobacco smoking in childhood is becoming a critical concern and needs to be addressed to prevent the development of cardiovascular disease such as coronary artery disease in adulthood. Recently, it has been confirmed that atherosclerosis begins in childhood and is associated with the same risk factors, including tobacco smoking, identified in adults [10]. Therefore, it is imperative to minimize these risk factors in early childhood to prevent disease development in adulthood. Another concern is the increased use of vapes and electronic cigarettes in the youth, particularly among those who have never used tobacco cigarettes, eventually transitioning to tobacco smoking.

The childhood and adolescent period should be a window of opportunity for pediatricians for risk assessment and prevention of disease development [11]. While many intervention strategies, such as policy development and implementation toolkits for educational settings, were identified as effective approaches in preventing smoking in adolescents, it is imperative that researchers and governmental organizations not only educate the adolescents, but the community as a whole. Finally, it is important to include parents and grandparents as a driver to change the community's

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understanding of the harmful effects of smoking and second-hand smoke exposure. Lastly, the study highlights the importance of primordial prevention: preventing the development of risk factors, rather than disease development, even after smoking cessation.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### CRediT authorship contribution statement

**Tammy C. Ras:** Conceptualization, Writing – original draft, Writing – review & editing.

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