

# Noncommunicable chronic disease prevention should start from childhood

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Noncommunicable chronic diseases (NCDs), such as cardiovascular disease (CVD), diabetes, cancers, and osteoporosis, are the leading causes of death and health costs. According to the 2020 Report on Chinese Resident's Chronic Disease and Nutrition, NCDs account for 88.5% of China's disease burden in 2019, more than all other causes combined. Great achievements have been made in reducing NCD-related mortality in high-income countries, whereas the health and socioeconomic burden caused by NCDs, particularly for CVD, continue to increase in China.<sup>1</sup> In 2017, the Chinese State Council issued the "Medium-to-Long Term Plan of China for the Prevention and Treatment of Chronic Diseases (2017–2025)", which aims to reduce by 20% of premature mortality from NCDs by 2025.<sup>2</sup> However, with the rapid economic growth and urbanization and the accelerated population aging over the last three decades, the prevalence of obesity and other NCD-related risk factors in adults is continuously rising and needs more attention. Conventional strategies targeting NCD risk factors in middle and old ages are far from sufficient to curb the growing burden from NCDs. There is growing evidence that life-course approaches that consider prevention and control of NCDs at an early life, particularly in childhood, may be an optimal strategy to reduce huge disease burden from NCDs.

NCDs are characterized by long duration and generally slow progression. Although clinical manifestations of many NCDs often occur from middle age, the pathogenic

process of NCDs has begun early in life. Atherosclerosis is the pathological basis of CVD. Autopsy studies of young people, including the Bogalusa Heart Study and the Pathobiological Determinants of Atherosclerosis in Youth<sup>3-6</sup>, have shown that fatty streaks and fibrous plaques in the aorta and coronary arteries are present in adolescents and young adults, and the subclinical vascular changes are correlated with the presence of cardiovascular risk factors including obesity, elevated blood pressure, dyslipidemia, diabetes mellitus and cigarette smoking. These findings suggest that the atherosclerosis process originates from childhood and risk factor intervention in youth might delay the process of atherosclerotic alteration and thus reduce future CVD risk. Osteoporosis is another significant chronic disease, and the development of osteoporosis also stems from childhood. Studies have shown that bone mineral accrual in childhood and adolescence predicts adult bone health, and 40% of bone mass is acquired during adolescence, 90% of bone mass is accumulated by 18 years, and childhood low bone mass predicts future risk of osteoporosis.<sup>7</sup>

Unfortunately, many NCD-related risk factors among children and adolescents, particularly for obesity and its related risk factors, are prevalent in China and continue to deteriorate as a consequence of unhealthy lifestyles including poor dietary habits and lack of physical activity. Recent data from the Chinese National Survey on Students' Constitution and Health showed that a marked

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increase has occurred in the prevalence of obesity in Chinese children and adolescents, particularly in rural areas, and the overall prevalence of overweight and obesity increased from 5.3% in 1995 to 20.5% in 2014.<sup>8</sup> Elevated blood pressure and dyslipidemia are among the most common consequences of childhood obesity. Data from the China Health and Nutrition Survey showed that the prevalence of elevated blood pressure defined using the 2018 Chinese Hypertension Prevention and Treatment Guideline reference from 8.9% in 1991 to 20.5% in 2015.<sup>9</sup> Our meta-analysis showed that the prevalence of dyslipidemia among Chinese children aged 7–18 years was 31.6%.<sup>10</sup> Unhealthy lifestyles are the root cause of obesity and many chronic health conditions, and healthy lifestyles can improve existing risk factors. According to the recommendation from World Health Organization, children aged 5–17 should accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity daily, but only 23.8% of Chinese children and adolescents have 60 minutes or more of physical activity in 2014.<sup>11</sup> A multistage random study including 6974 children from six provincial capital cities showed that 46.1% of children regularly consumed sugar-sweetened beverage in 2010.<sup>12</sup>

To comprehensively evaluate cardiovascular health status, the American Heart Association defines ideal cardiovascular health for adults and youths based on seven health components, including four health behaviors (smoking, body mass index, physical activity and healthy diet score) and three health factors (total cholesterol, blood pressure and fasting plasma glucose).<sup>13</sup> Using data from China Child and Adolescent Cardiovascular Health study conducted during 2013–2015 that included 13 395 participants aged 6–18 years from 7 cities, we found that there was extremely low prevalence of ideal cardiovascular health defined as meeting all 7 ideal components (overall, 0.5%; males, 0.5% and females, 0.4%).<sup>14</sup> Of the 7 health behaviors/factors, ideal health diet was the least prevalent. Thus, there is an urgent need to take effective measures to improve cardiovascular health in children.

Many lifespan cohorts from several countries, including ours, beginning in childhood with a follow-up into adulthood provide strong evidence that most of NCD risk factors moderately or strongly track from childhood to adulthood, which means that children with these risk factors often grow up to become adults also with these risk factors if no effective interventions are implemented. For instance, about one-third of obese preschool children are obese as adults, and about half of obese school-age children are obese as adults.<sup>15</sup> Also, exposure to risk factors in childhood contributes to increased risks of many NCDs later in life. Using data from Beijing Blood Pressure Cohort study established in 1987 and with more than 20 years of follow-up, our several previous publications have shown that childhood adiposity was

associated with increased risks of diabetes, metabolic syndrome and fatty liver,<sup>16,17</sup> and childhood excess weight and elevated blood pressure play a dual burden on adult subclinical development of CVDs, including left ventricular remodeling and subclinical vascular alterations measured as intima-media thickness and pulse wave velocity.<sup>18,19</sup> All these findings suggest that effective interventions targeting risk factors in childhood may reduce risk of future NCDs.

Childhood is a critical period among all life stages and is characterized by rapid physical, neurological, and social development. During this period, individuals' behavior habits including diet and exercise are being established. Once unhealthy behavioral habits are established at an early age, they will strongly track into adulthood without effective and timely intervention strategies. Thus, developing healthy lifestyle habits in childhood and maintaining them into adulthood will bring lifelong health benefits. Children and adolescents spend a lot of time in schools which is a good setting for monitoring NCD-related risk factors and carrying on health promotion activities. Appropriate school-based intervention approaches can foster healthy behaviors and effectively promote long-lasting health effects.

Obesity is a significant risk factor for increased morbidity and mortality from many chronic diseases. Interventions targeting childhood obesity are important because childhood obesity can persist into adulthood and contributes to increased risks of CVD, diabetes, and other chronic diseases. To reduce health consequences of childhood obesity, Chinese six ministries and commissions, including the National Health Commission, Ministry of Education and the General Administration of Sport, issued an implementation plan for the prevention and control of obesity in children and adolescents in October 2020, and the overall goal is to reduce the average annual growth rate of overweight and obesity among children aged 0–18 years by 70 percent from the current baseline from 2020 to 2030.<sup>20</sup> The plan asked parents, schools, medical institutions and the government to take their responsibilities in different sectors to jointly tackle the threat of childhood obesity epidemic.

In summary, many NCDs have their origins in youth, and exposure to risk factors in childhood contributes to the development of adult NCDs. Given the high prevalence of NCD-related risk factors in childhood, the intervention window for reducing NCDs should be shifted from adulthood to childhood. Effective intervention approaches promoting healthy lifestyle behaviors for Chinese young children urgently need to be developed to reduce the NCD burden.

## CONFLICT OF INTEREST

None.

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