High blood pressure in children: The invisible dragon

High blood pressure in childhood is asymptomatic, is often unrecognized, and is the harbinger of the early onset of noncommunicable diseases in adult life.[1] More than labeled hypertension, a casual blood pressure reading of more than 110 mm of Hg is the leading cause of morbidity and mortality for humankind.[2,3] Because of its long-term health effects, asymptomatic high blood pressure and its causative factors are considered as silent killers.[4,5] If the currently available numbers are extrapolated, India and China can now compete for the title of hypertension capital for the world.[6,7] The article by Patel *et al.* from the state of Madhya Pradesh in India, in this issue, achieves its relevance by unmasking this invisible catastrophe beginning in childhood and adds to the data from other studies in children from various parts of India.[8] We need to look at the public health implications regarding this tip of the iceberg, which heralds the raise of the deadly dragon hiding beneath.

HYPERTENSION IN DEVELOPING WORLD: A FUNDAMENTAL DIVERGENCE

Systemic arterial hypertension is a major cause of morbidity and mortality in the developing world next only to childhood underweight in the pediatric age group.[9] Unlike the developing world, where decline in systolic blood pressure is now documented, the developing world has shown an increase in the burden due to hypertension out of proportion to obesity, over the last few decades.[10] Childhood obesity and abdominal obesity predispose for pediatric hypertension, but normal-weight children in developing world have recorded highest recorded blood pressure values compared to the data from the rest of the world.[11-13] There have been multiple attempts to explain the ethnic difference in pediatric hypertension by implying salt sensitivity, low birth weight, short stature, family history, insulin resistance, and micronutrient deficiency.[14,15] Positive energy balance reflected by increasing obesity is the driving force for the noncommunicable disease epidemic, but many in the developing world develop noncommunicable disease risk factors and diseases, before achieving the BMI cut off values of overweight and obesity for Asians at that age.[13,16,17] Habituation to tobacco use and alcohol consumption and environmental pollution by noise, lead, and mercury are the other preventable contributors.[18] By and large, it can be seen that globalization and rapid urbanization adversely affect the people in the low- and middle-income countries more.[19] Hypertension heralds the onset of other noncommunicable diseases and risk factors in the developing world, and its incidence is almost double that of diabetes in the various age groups studied.[19-21]

IF HARD TO MEASURE, TARGET PEDIATRIC BLOOD PRESSURE

Blood pressure is universal whereas pediatric hypertension identifies a subset based on the criteria, where underdiagnosis (masked hypertension) and overdiagnosis (white coat hypertension) is reported and may need more cumbersome methods such as ambulatory blood pressure recordings and percentile tables.[22,23] Similarly, identifying a child as hypertensive makes the pediatrician "uncomfortable," the child feels discriminated, and parents become panicky. There are many limitations for measuring blood pressure, a varying physiologic parameter, in a busy pediatric practice in our country. Appropriate cuffs are often not available and the environ is very stressful and most office visits are for a childhood illness. That is where studies as reported by Patel *et al.* achieves its public health relevance using standard methodology, piggybacking on another funded rheumatic fever study, in a more comfortable school setting.[8] Lifetime risk of developing hypertension in the United States is 9 out of 10 and could be more in the developing world.[24] One point increase in systemic blood pressure in children increases the likelihood of developing hypertension in adult life by 10%.[25] Therefore, initiating lifestyle modification for lowering blood pressure is the ideal universal primary prevention strategy, when the community incidence and prevalence is so high.[7]

HOW TO MEASURE? AUTOMATED VERSUS MANUAL SPHYGMOMANOMETRY

Standard recommendations are available regarding the method of measurement, but the trouble starts with the selection of appropriate sphygmomanometer.[26] Currently available indirect methods of estimating arterial blood pressure are near approximations and depend

heavily on the cuff size and standard of the instrument and measurement.[27] Cuff width recommended is 40% of mid-arm circumference, but the best correlation was provided by a cuff size of 46% for systolic and 55% for diastolic blood pressure when compared with intra-arterial recordings.[28] Compared to manual blood pressure recording, automated sphygmomanometers are more comfortable and may be child-friendly. Although considered as the gold standard, many countries have banned mercury manometers.[29] Compared to manual recording, oscillometric recordings show an average of 9-mm higher systolic and 5-mm lower diastolic blood pressures.[29] For community studies, currently, oscillometric recordings are considered to be appropriate because automated machines avoid digit preference and provide and additional information on heart rate and is visible to the person evaluated.[30] Increasing pulse rate is an indirect indicator of stress, sympathetic overactivity and decreasing physical fitness, and long-term predictor of cardiovascular mortality.[31,32] Heart rate at adolescence not only gives a prediction of future cardiovascular health, but trends in heart rate in children have also shown good correlation with incident hypertension in later life.[33,34] Given the errors that are possible, it is more practical to stick to systolic blood pressure and heart rate records using an oscillometric sphygmomanometer in long-term studies and is easy to generate by committed health workers at the community setting than at office.[35] Casual systolic blood pressure was shown to correlate with long-term cardiovascular mortality in a large epidemiologic study from Kerala.[36] Sick babies need blood pressure monitoring. Kids when they are well also need a blood pressure recording more in a friendly environ, maybe by a health worker. Like charting the height and weight, charting heart rate and systolic blood pressure are the best measures to track, if electronic records and digital instruments are available to ensure future cardiovascular health.[13,34] We did a community survey of hypertension in children and compared with similar data from China and Mexico.[13] Girls in Kerala, India, had the highest prevalence of hypertension (12.7%) and prehypertension (9.7%).[13] Digital sphygmomanometers used provided useful data on heart rate, which showed high resting heart rates in these girls (unpublished data), reflecting the physical deconditioning or the higher stress level these children are subjected to.[37,38] It is prudent for the authors to recommend blood pressure recording at clinic visit, but is judicious and proper to get the numbers in a representative and reproducible fashion, entered electronically for tracking in healthy screening environment like the school health programs, maybe twice a year with additional anthropometric data.[8] For these digital machines, with standard pediatric cuffs, with palpatory confirmation of systolic blood pressure and simultaneous observation of heart rate could be the best parameter as of today.

ONE-THIRD REDUCTION BY THE YEAR 2030

To achieve the current sustainable development goal of one-third reduction in premature noncommunicable disease mortality by the year 2030,[39] we need to start young and finish strong as demonstrated in the Young Finns Study.[40] Hypertension is the most important noncommunicable disease risk factor in India contributing for 1.6 million deaths and 33.9 million disability-adjusted life years as per the data in 2015.[41] Being a socially transmitted disease, we need to enable the society to tackle it.[41] That is where nonlaboratory markers of screening for risk factors at school level achieves their relevance.[42] School setting is ideal, where height, weight, heart rate, and systolic blood pressure can be measured by the school staff, once or twice a year and tracked on to school health record. At the school level, percentile charts and BMI calculation and diastolic blood pressure measurement will call for added expertise, and may not be cost effective, unless implemented with dedication. On the other hand, a long thread, if not a measuring tape with a stadiometer, can decipher a waist height ratio of <50%.[43] Children should be encouraged to achieve ideal cardiovascular health matrices to prevent the adult onset disease.[44] It is in this context surveys by Patel *et al.* helps us to understand the gravity of the situation which could help the policymakers adopt practical solutions.[8] Possibly a systolic blood pressure measure of more than 110 mmHg, a heart rate of >90, and waist height ratio of more than 50% in children more than 6 years of age at the school setting could be suggested as indicators for intensifying the primary prevention strategies such as improving the physical fitness and reducing weight, with emphasis on healthy food and sleep.[45-48] Waist–height ratio more than 50%, heart rate more than 100/min, and systolic blood pressure of more than 120 mmHg needs to referred to a pediatrician for further evaluation and management.

TARGET: CHILDREN AND ADOLESCENTS, WE NEED TO "GO RED"

"Go Red for Women" campaign by the American Heart Association looks at the gender issues in the prevention and management of noncommunicable diseases, which have adverse health implications for women.[49] However, in the developed world, the early onset of noncommunicable disease risk factors in women in the reproductive age group is more damaging and exponential.[19,50] Many of the studies including the current study report a high prevalence of elevated blood pressure in children, especially in girls, which is a harbinger of more trouble in view of the intergenerational influences.[12,13] If the school health

program can integrate heart rate and systolic blood pressure monitoring with the "string test", for abdominal obesity, children can be tracked on to a better healthy lifestyle. By increasing their physical activity, and implementing healthy diet free of junk food, we should ensure safe motherhood, free of polycystic ovarian disease, dyslipidemia, hypertension, and dysglycemia. Increasing blood pressure is the head of the hidden dragon, is the harbinger for the future cardiovascular diseases, and is revealed by the numbers generated in this study, calling for urgent societal action.[8]

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