SPECIAL REPORTS

Screening for high blood pressure in children/adolescents – why it matters

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High blood pressure continues to be the main risk factor for cardiovascular disease despite our collective efforts in research and screening. In addition to new treatments and lifestyle modifications to control it, early detection and preventive efforts starting in childhood are needed to reduce the global burden of hypertension We have an effective screening program with May Measurement Month to raise awareness among adults, and although we consider it challenging to implement a similar program for children, we have a unique opportunity to adopt initiatives to initiate change and engage our community for self-management of hypertension. Global efforts being implemented by members of the ISH Communications Committee, as well as other international colleagues from Africa, Australia, Japan and the USA, are outlined below.

Japan

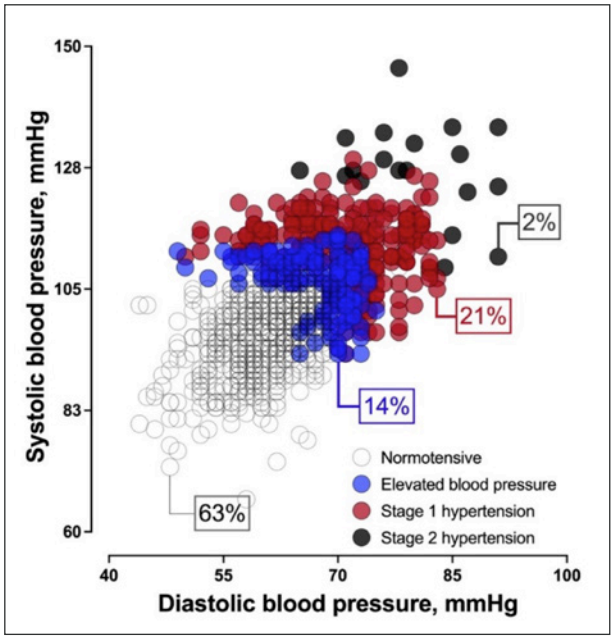
The first initiative is from Japan with Hidehiro Kaneko and Akira Nishiyama identifying that opportunities for young individuals to undergo blood pressure measurements during routine physical examinations are exceedingly limited. Consequently, their comprehension and awareness of blood pressure remain restricted, and the precise blood pressure levels within this demographic have yet to be ascertained. As a result, there exists no comprehensive national data offering an accurate depiction of the prevalence of hypertension among young individuals. Earlier investigations suggested that not only stage 2, but also stage 1 hypertension was associated with an increased risk of developing heart failure and atrial fibrillation among the relatively younger population in Japan.[1] The association of

hypertension with incident cardiovascular disease was more pronounced in younger people than in older people.[2] Cardiovascular health metrics clearly stratified a risk of developing both stage 1 and stage 2 hypertension among young adults, suggesting the clinical importance of modifiable risk factors in the development of hypertension in young adults.[3] This underscores the pressing need for educational initiatives geared towards raising awareness about blood pressure among young people and implementing preventive measures to curb hypertension within this age group. To address this issue, the Japanese Society of Hypertension (JSH) is actively advocating for the inclusion of blood pressure measurements as a standard component of health checkups for high school students. They are proposing to use the Saga Prefecture, the home prefecture of the current JSH chairman, as a model case to pilot this approach. Furthermore, JSH is actively engaged in efforts to promote blood pressure measurement awareness and practices among young people more broadly.

Africa

In Africa the combined prevalence of elevated blood pressure and hypertension in children is just under 22%.[4] This prevalence remains highly debated due to childhood blood pressure nomograms are lacking across Africa and the rates of hypertension are based on guidelines developed in countries with the lowest to no number of children from African ancestry.[5] The applicability of international blood pressure nomograms in Africa remains uncertain as described by a study done in South Africa that compared several international reference values with a cohort profile from the Eastern Cape region. Normal blood pressure was largely underestimated by all international references (by ±20%), while elevated blood pressure (7.2-11.4%), stage 1 (17.7-20.2%) and stage 2 (7.9-10.8%) hypertension was overestimated by all international references compared to the South African cohort defined reference.[6] In South Africa, a recent analysis using the 2017 AAP CPG blood pressure classification reported a combined prevalence of almost 37% of children with elevated blood pressure (14%), stage 1 (21%) and stage 2 (2%) hypertension[7], see **Figure 1**. The mean blood pressures were calculated using the 3 lowest measurements of the 5 total measurements, highlighting the frighteningly high prevalence of elevated blood pressure in these children.

Figure 1. Blood pressure distribution and prevalence of hypertension by automated blood pressure measurements in 5–9-year-old children (n=1062) from South Africa.



In the same study, boys and girls of similar age (mean age 7.43 years) showed no differences in body composition (except for boys being on average 1cm taller than the girls), brachial systolic blood pressure or central systolic and diastolic blood pressure. Office diastolic blood pressure, total vascular resistance and central pulse pressure were higher in girls compared to boys.[7] The higher brachial diastolic blood pressure may be a result of a lower vasodilator capacity as reflected by higher total vascular resistance and a potential forward pulse wave propagation that contributes to the higher central pulse pressure. Further work is currently underway to understand

the sex differences at various levels including basal metabolism, genetics and endocrine regulation.

From the paediatric hypertension research done by Ruan Kruger and his team, it became clear that health education and awareness of the dangers of high blood pressure from as early as childhood had to be addressed. A series of educational tools were developed by the Hypertension in Africa Research Team of the North-West University in South Africa to promote community screening programs and awareness initiatives, especially in the school setting. A superhero character was developed, namely Captain Heart, and was used in a comic book developed and translated into 3 of the 11 official languages of the country for distribution in primary schools. A video was further developed that plays in community healthcare facilities and is distributed to libraries in schools, while information cards for parents were developed to inform them of the dangers of unhealthy lifestyle behaviours and how to address these from a young age. These resources are publicly available here: https://health-sciences.nwu.ac.za/examin-youth-sa/home

Despite several efforts to understand childhood onset of hypertension in Africa, remaining challenges include limited access to healthcare, inadequate resources for screening and diagnosis, and poor awareness among caregivers and healthcare professionals regarding the importance of early detection and management. Overall, the studies addressing childhood hypertension have emphasised that research, resources, and policies need to be upscaled to address this burgeoning public health concern. Therefore, to further expand on the research and improve healthcare in children with early hypertension risk, the Childhood Hypertension Consortium of South Africa (CHCSA) was established, a non-profit organisation under the presidency of Ruan Kruger. The CHCSA consists of experts in the field of paediatric hypertension, representing all provinces in the country with a primary focus on cardiovascular health in children and adolescents in South Africa. The CHCSA aims to drive policy change in healthcare for children and adolescents in South Africa and contribute to ongoing community engagement and outreach to promote health education among parents, teachers and children. The CHCSA is driving a national research

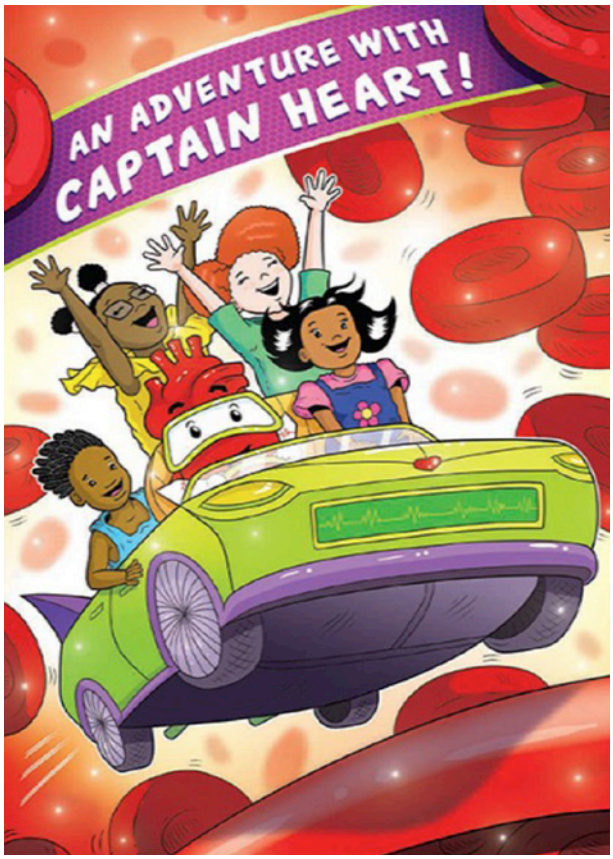


Figure 2. The cover page of the English version of "An adventure with Captain Heart" comic book developed for primary school children

study (ClinicalTrials.gov: NCT05982847) in South Africa aimed at improving hypertension care and management among the childhood and adolescent populations of the country and to develop the first South African blood pressure nomograms in paediatrics and will in future expand expertise to other African countries. To learn more about the consortium, please visit the website here: https://www.chc-sa.org

USA

In the United States there has been publication of updated normative blood pressure (BP) data and adoption of the lower adult BP cut-points for adolescents ≥13 years of age in the 2017 American Academy of Pediatrics Clinical Practice Guideline (AAP CPG).[8] This has led to identification of greater numbers of American children as having high BP. Using the prior normative data from the 2004 "Fourth Report" in an analysis of data from the US National Health and Nutrition Examination Survey (NHANES) collected between 2008 and

2012, the incidence of hypertensive-range BP (≥95th percentile) in participants between 8-17 years of age was 1.6%, with another 9.4% having BP readings in the high-normal/elevated range (≥90th and <95th percentiles), for a combined prevalence of 11%.[9] When similar NHANES data were re-analyzed after publication of the AAP CPG, the prevalence of high BP (combining elevated and hypertensive categories) increased from 11.8% to 14.2%, with many of the children who were reclassified to a higher BP category having other cardiovascular risk factors such as high body mass index and dyslipidemia.[10]

Two recent analyses of NHANES data confirm an overall prevalence of hypertension of about 4% in American children. In a detailed analysis of BP trends among US children and adolescents over several NHANES cycles over 1999-2018, the prevalence of hypertension was 4.6% in children 8-12 years of age and 3.7% in adolescents 13-17 years of age, with another 6-8% having elevated BP.[11] Other findings of interest were that BP was higher in youth with overweight and obesity than those of normal weight, that boys had higher BP than girls, and that non-Hispanic Black children had higher BP than non-Hispanic White children. Finally, a combined analysis of BP data in children 8-18 years of age collected in NHANES surveys conducted between 2011-2018 and BP data from the China Child and Adolescent Cardiovascular Health study collected between 2013-15 showed that the age-standardized prevalence rate of hypertension was 4% in US children and 18.5% in Chinese children.[12] Interestingly, obesity was associated with hypertension in US children but not in Chinese children.

Australia

In Australia the prevalence of paediatric hypertension is similar to that reported globally, with 3-7% classified as hypertensive and a further 4-8% with elevated blood pressure, with no difference between males and females.[13,14] Australian hypertension guidelines currently address adults only, which creates the conception amongst many clinicians that paediatric hypertension is not an issue that needs to be addressed. We have therefore created a professional network called BPOzKids, which together with Hypertension Australia, is developing Australia's first clinical guidelines for paediatric hypertension. Another key gap in Australia is a feasible avenue for hypertension screening in children. We are therefore currently conducting a pilot "Healthy Hearts @ School" program where we are investigating acceptability of and optimal methodology for screening in this context. The program incorporates two rounds of screening during school hours several weeks apart, along with targeted 24-hour ambulatory monitoring in a subset of consenting students. A rewarding aspect of this program has been delivery of a heart health education program to all Grade 3-6 students at the participating schools, and seeing the student's enthusiasm for learning about how the cardiovascular system works, how we can look after it, and what blood pressure is all about (teaching the kids to say "sphygmomanometer" has been a particular highlight!).

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Correction from the September issue of Hypertension News

In the last edition of Hypertension News, the following sentence appeared on page 33: "We are aware that afferent renal sympathetic nerves stimulate juxtaglomerular cells, which, in turn, increase renin release, decrease renal perfusion, and increase sodium reabsorption."
In this sentence, the word 'afferent' should have been 'efferent'.