



RESEARCH ARTICLE

White Coat Hypertension in Children and Adolescents: Innocent or Not?

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Abstract

Background: The clinical significance of white coat hypertension is still uncertain. We aimed to evaluate children with white coat hypertension regarding their clinical, laboratory characteristics, evidence of target organ damage and compare them to normotensive and hypertensive children.

Methods: Forty patients diagnosed with white coat hypertension, 40 patients with primary hypertension and 40 normotensive children of similar age, gender and body mass index were included in the study. Ambulatory blood pressure monitoring and echocardiographic examination were performed to all children. Clinical and laboratory characteristics were noted.

Results: All ambulatory blood pressure monitoring parameters, except night-time diastolic blood pressures and loads, were significantly higher in patients with white coat hypertension compared to normotensive ones. Left ventricular hypertrophy was 35% in the primary, 15% in the white coat hypertension group, and no left ventricular hypertrophy was detected in normotensive patients. No significant difference was found between 3 groups in terms of proteinuria or retinopathy.

Conclusions: Children diagnosed with white coat hypertension had ambulatory blood pressure monitoring measurements and left ventricular mass index values smaller than patients with primary hypertension but more than normotensive children. Echocardiographic changes might suggest that white coat hypertension can be associated with target-organ damage.

Keywords

Blood pressure, Hypertension, White coat hypertension, Left ventricular hypertrophy

Introduction

After the advent of ambulatory blood pressure monitoring (ABPM) the management of blood pressure (BP) has dramatically changed [1,2]. Ambulatory blood pressure monitoring provides a more accurate measurement of BP than auscultatory or automated office readings and it is shown to be superior in administration or adjustment of antihypertensive treatment and prediction of cardiovascular morbidity. Another superiority of ABPM is the detection of white coat hypertension (WCH) and avoiding unnecessary further testing in these patients. As highlighted by the recent American Academy of Pediatrics Clinical Practice Guideline for Screening and Management of Elevated Blood Pressure in Children and Adolescents, the majority of the pediatric population has primary HT. However, emphasis was placed on evaluation for WCH by ABPM before diagnosing HT [2].

White coat HT is defined as elevated office BP measurements with normal BPs outside of the office setting. Ambulatory BP monitoring is often utilized for establishing the diagnosis. Various studies have reported a wide range in WCH prevalence ranging from 12.9% to 88% of children depending on the criteria used [3-5]. Clinical significance of WCH in children is a matter of debate. Since several earlier studies did not show significant target organ damage associated with WCH and it has been believed that WCH is a rather benign condition in children which does not require therapeutic

tic intervention or monitoring [5,6]. Even in adults, the clinical significance remained uncertain and most studies indicated that the risk of cardiovascular disease in WCH was comparable to that of normotension [7]. Recently it has been shown that WCH leads to cardiovascular changes and is slightly effective on mortality and morbidity in contrast to previous studies [8-12]. However, this effect was not as apparent as with primary hypertension [11].

The aim of this study was to compare the patients diagnosed with WCH to their age, gender and BMI matched counterparts with primary HT and normotension, regarding clinical and laboratory characteristics, ABPM measurements and target organ damage.

Materials and Methods

Study population

A retrospective study was performed at Dr. Sami Ulus Maternity Child Health and Diseases Training and Research Hospital. Patients aged 5-19 years and with a height of ≥ 120 cm, referred to the Division of Pediatric Nephrology for evaluation of elevated BP, underwent ABPM between January 2013 and December 2018 were included. Only patients taller than 120 cm were included due to absence of ABPM reference values for children under this height. In the clinic, BP measurements were repeated 3 times with 10-min intervals in a sitting position. A mercury sphygmomanometer with an appropriately sized cuff was used by the same physician. For casual BP measurements HT was diagnosed when the mean of 3 BP measurements was greater than the 95th percentile for age, sex, and height in children < 13 -years-old or $> 130/80$ mmHg in children ≥ 13 year of age according to the latest guidelines of American Academy of Pediatrics [2]. Patients with evidence of secondary HT and those already on anti-hypertensive medication were excluded. Secondary HT was diagnosed based on medical history, physical examination, laboratory and radiological examinations as appropriate. Forty patients with diagnosis of WCH, 40 with primary HT and 40 normotensive healthy controls of similar age, gender and body mass index were included in the study. Echocardiographic examination and ABPM were performed to all children.

All patients signed the informed voluntary consents approved by the institutional ethics committee of Keçiören Training and Research Hospital, in accordance with the Declaration of Helsinki (2012-KAEK-15/1909).

Ambulatory blood pressure monitoring

A non-invasive oscillometric monitor (Mobil-O-graph®NG, version 20, Stolberg, Germany) was used for ABPM. The monitor was set up to measure BP every 20 min between 08:00 and 20:00, and every 30 min between 20:00 and 08:00. Daily activities were

not limited during ABPM. Daytime, nighttime and 24-h ABPM parameters were recorded for all patients. Monitoring was considered reliable if more than 70% of the measurements were valid. Records with fewer than 70% readings were considered unsuccessful and repeated. Decrement of mean systolic or diastolic BP over 10% between daytime and nighttime measurements was defined as dipping. Blood pressure load was defined as the percentage of measurements that were above the 95th percentile for age, gender and height. Hypertension was defined as elevated mean 24-h BP above the 95th percentile adjusted for height and an elevated systolic and/or diastolic BP load above 25% [2,13]. Children with BP over the 95th percentile on casual measurements and normal values on ABPM were considered to have WCH.

Echocardiography

Echocardiographic study was performed with a commercially available standard ultrasound scanner (Vivid 7; General Electric Medical Systems, Horten, Norway) with 3.0- and 7.5- MHz transducers. Echocardiographic evaluation and analysis of left ventricular measurements were performed by the same cardiologist. The LV mass was calculated according to the Devereux formula and indexed to height^{2.7} as left ventricular mass index (LVMI) [14]. The sex and age-specific LVMI partition values defined by Khoury, et al. were used to define left ventricular hypertrophy (LVH) [15].

Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 20.0 for Windows was used for statistical evaluations. The results were presented as mean value \pm one standard deviation. A p value < 0.05 was considered statistically significant. The differences between three independent groups were compared by using one-way ANOVA with Tukey test for normal distributions or Kruskal-Wallis H-test with Bonferroni adjusted Mann-Whitney U-test for non-normal distributions.

Results

Forty patients were diagnosed with WCH (mean age, 14.4 \pm 2.8 years) among children referred for ABPM. These patients were compared with 40 primary HT (mean age, 13.4 \pm 2.5 years) and 40 normotensive patients (mean age, 14.3 \pm 1.76) with similar age, sex, and BMI. There was no significant difference between the primary HT and WCH patients regarding family history of HT (p = 0.201). Uric acid levels were significantly higher in primary HT group. Demographic data and laboratory findings of the patients, are given in Table 1.

The overall results of ambulatory blood pressure monitoring are presented in Table 2. The 24-h mean SBP, day-time SBP, night-time SBP, 24-h mean DBP, day-

Table 1: Clinical and laboratory characteristics of patients.

	Primary HT (n = 40)	WCH (n = 40)	Control (n = 40)	p
Age at diagnosis, year (s)	13.4 ± 2.57	14.4 ± 2.80	14.3 ± 1.76	0.137
Male sex, no. (%)	22 (55%)	26 (65%)	17 (56.7%)	0.636
BMI (kg/m ²)	24.1 ± 4.08	23.3 ± 3.0	22.8 ± 2.81	0.317
BMI-SDS	0.88 ± 1.13	0.83 ± 0.77	0.77 ± 1.01	0.249
BMI ≥ 95 th percentile (%)	40	38	36	0.917
Family history of hypertension, no. (%)	21 (52.5%)	13 (32.5%)	2 (6.6%)	p ^a = 0.201 p ^b = 0.014
eGFR (ml/min/1.73 m ²)	106.6 ± 17.4	107.8 ± 16.8	105.5 ± 18.2	0.629
Uric acid (mg/dl)	6.5 ± 2.1	4.6 ± 0.9	4.2 ± 0.7	p ^a < 0.001 p ^b = 0.208
Casual systolic BP (mmHg)	135.3 ± 6.54	134.5 ± 5.22	105.8 ± 8.61	p ^a = 0.907 p ^b < 0.001
Casual diastolic BP (mmHg)	84.0 ± 6.54	80.9 ± 5.12	67.8 ± 7.62	p ^a = 0.930 p ^b < 0.001

p^a: White coat hypertension-primary hypertension group; p^b: White coat hypertension-control group.

HT: Hypertension; WCH: White Coat Hypertension; BMI: Body Mass Index; SDS: Standard Deviation Score; eGFR: Estimated Glomerular Filtration Rate; BP: Blood Pressure.

Table 2: 24-hour ambulatory blood pressure monitoring parameters.

	Primary HT (n = 40)	WCH (n = 40)	Control (n = 40)	p
24-h SBP (mmHg)	134.0 ± 5.53	124.0 ± 6.65	104.5 ± 6.22	p ^a < 0.001 p ^b < 0.001
24-h SBP-SDS	2.68 ± 0.54	1.15 ± 0.42	-1.1 ± 0.94	p ^a < 0.001 p ^b < 0.001
Day-time SBP (mmHg)	136.6 ± 6.54	129.0 ± 6.55	108.1 ± 5.99	p ^a < 0.001 p ^b < 0.001
Day-time SBP-SDS	2.2 ± 0.52	0.98 ± 0.37	-1.1 ± 0.90	p ^a < 0.001 p ^b < 0.001
Night-time SBP (mmHg)	121.2 ± 6.30	114.1 ± 6.12	100.2 ± 6.29	p ^a < 0.001 p ^b < 0.001
Night-time SBP-SDS	2.19 ± 0.80	1.14 ± 0.36	-0.1 ± 0.86	p ^a < 0.001 p ^b < 0.001
24-h DBP (mmHg)	82.5 ± 5.27	72.1 ± 3.01	63.5 ± 5.58	p ^a < 0.001 p ^b < 0.001
24-h DBP-SDS	2.61 ± 0.99	0.79 ± 0.50	-0.67 ± 1.1	p ^a < 0.001 p ^b < 0.001
Day-time DBP (mmHg)	84.4 ± 4.78	76.8 ± 2.88	68.2 ± 5.04	p ^a < 0.001 p ^b < 0.001
Day-time DBP-SDS	2.07 ± 0.83	0.69 ± 0.48	-0.6 ± 0.79	p ^a < 0.001 p ^b < 0.001
Night-time DBP (mmHg)	66.7 ± 6.25	58.8 ± 4.97	57.5 ± 0.68	p ^a < 0.001 p ^b = 0.423
Night-time DBP-SDS	1.77 ± 1.0	0.57 ± 0.68	0.49 ± 0.79	p ^a < 0.001 p ^b = 0.075
24-h MAP (mmHg)	99.7 ± 5.13	87.8 ± 3.93	77.0 ± 5.05	p ^a < 0.001 p ^b < 0.001

24-h MAP-SDS	3.17 ± 1.0	0.78 ± 0.52	-0.74 ± 0.83	p ^a < 0.001 p ^b < 0.001
Day-time MAP (mmHg)	100.6 ± 4.92	92.1 ± 3.89	81.4 ± 4.82	p ^a < 0.001 p ^b < 0.001
Day-time MAP-SDS	2.2 ± 0.78	0.72 ± 0.49	-0.68 ± 0.69	p ^a < 0.001 p ^b < 0.001
Night-time MAP (mmHg)	83.9 ± 5.82	76.9 ± 3.77	72.7 ± 4.38	p ^a < 0.001 p ^b < 0.001
Night-time MAP-SDS	1.89 ± 0.67	0.71 ± 0.45	0.19 ± 0.79	p ^a < 0.001 p ^b = 0.007
24-h SBP load (%)	43.7 ± 17.8	14.5 ± 5.95	8.6 ± 3.86	p ^a < 0.001 p ^b < 0.001
Day-time SBP load (%)	45.1 ± 21.8	13.2 ± 5.46	6.7 ± 3.86	p ^a < 0.001 p ^b < 0.001
Night-time SBP load (%)	61.8 ± 24.0	10.2 ± 7.58	6.4 ± 4.0	p ^a < 0.001 p ^b = 0.030
24-h DBP load (%)	26.2 ± 18.2	7.8 ± 4.22	4.3 ± 3.86	p ^a < 0.001 p ^b < 0.001
Day-time DBP load (%)	43.1 ± 17.8	8.72 ± 4.69	5.61 ± 3.87	p ^a < 0.001 p ^b = 0.012
Night-time DBP load (%)	39.6 ± 23.0	4.15 ± 5.73	4.26 ± 4.43	p ^a < 0.001 p ^b = 0.966
Non-dipper (n, %)	29 (72.5%)	8 (20%)	0	p ^a < 0.001 p ^b = 0.010

p^a: White coat hypertension-primary hypertension group; p^b: White coat hypertension-control group.

HT: Hypertension; WCH: White Coat Hypertension; SDS: Standard Deviation Score; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; MAP: Mean Arterial Pressure,

Table 3: Frequency of target organ damage in patients.

	Primary HT (n = 40)	WCH (n = 40)	Control (n = 40)	p
LVH (n, %)	16 (35%)	6 (15%)	0	p ^a = 0.009 p ^b = 0.022
LVMI, g/m ^{2.7}	44.4 ± 13.5	36.5 ± 8.67	32.0 ± 2.51	p ^a = 0.025 p ^b = 0.046
Proteinuria (mg/m ² /h)	3.21 ± 0.9	2.85 ± 0.8	2.31 ± 0.9	p = 0.641
Retinopathy	6 (15%)	2 (5%)	0	p ^a = 0.365 p ^b = 0.407

p^a: White coat hypertension-primary hypertension group; p^b: White coat hypertension-control group.

HT: Hypertension; WCH: White Coat Hypertension; LVH: Left Ventricular Hypertrophy; LVMI: Left Ventricular Mass Index.

time DBP and night-time DBP were significantly higher in the primary HT group compared to the WCH (p < 0.001) and higher in the WCH group compared to controls (p < 0.001), except for night-time DBP (p = 0.423). Similarly 24-h SBP load and 24-h DBP load were significantly higher in primary HT patients compared to WCH (p < 0.001), and higher in WCH as compared to control group (p < 0.001). The night-time SBP and DBP load were significantly higher in the primary HT group than in the WCH whereas there was no statistical difference between WCH and control group regarding same parameters.

The prevalence of LVH in patients with primary HT and WCH were 35% and 15%, respectively. Left ventricular mass index in the primary HT group was significantly higher compared to WCH group, and in the WCH group LVMI was higher compared to control group (p = 0.025, p = 0.046 respectively). No statistically significant difference was found between 3 groups in terms of proteinuria or retinopathy (Table 3).

Discussion

Studies on adults suggest that WCH appear to be a

risk for progression to sustained hypertension, however pediatric population lacks similar data [16]. In adults with WCH it is found that LVMI falls between LVMI of patients with normal BP and sustained HT matched by BMI, gender, and age [17]. There are limited number of studies exploring the target organ damage in children with WCH, and their results are quite controversial [5,18,19].

Obesity is a well-known risk factor for HT and its complications. Unfortunately obesity prevalence is increasing, especially in developed countries. Several studies demonstrated the association between primary HT and obesity in children [20,21]. However there are few studies on WCH prevalence in overweight children. Floriańczyk T, et al. reported that BMI of children with WCH was higher than normotensive but smaller than hypertensive children [22]. In our study mean BMI of patients with WCH was 23.3 ± 3.0 and 38% of these patients had BMIs above 95 percentile for age and height. Since the BMIs of patients in normotensive and primary HT group were matched before enrollment, no comparison was possible between 3 groups. However, we think that ratio of BMI > 95th percentile as 38% in WCH is an important finding. Family history of HT is another risk factor for primary HT in children [23]. Either sharing the same environment or genetic susceptibility might underlie this predisposition. In our study, family history of HT was present in 52.5% of children with primary HT and 32.5% with WCH and there was no statistically significant difference between the 2 groups. In the control group, this rate was 6.6%.

As expected, in our study all ABPM parameters were significantly higher in children with primary HT compared to children with WCH. Except for night-time DBP, in WCH patients SBP and DBP values and also 24-h SBP load and 24-h DBP load were significantly higher in comparison to healthy controls. In their study Florianczyk, et al. found that SBP and SBP load in ABPM were significantly higher in sustained hypertensive group and WCH than normotensive children; furthermore, SBP and SBP load in WCH patients were significantly higher in comparison to healthy controls. They reported no significant difference in DBP and DBP load between WCH and normotensive children [22]. Sorof, et al. compared ABPM results of patients with WCH and healthy children, and found that SBP, SBP- and DBP-load were higher in patients with WCH, and there were no differences in terms of DBP, and systolic and diastolic nocturnal deep between 2 groups [3].

The clinical significance of WCH, in terms of cardiovascular outcomes, is still debated in adults. Studies showed that WCH was not an innocent condition and found the cardiovascular risk significantly higher in subjects with WCH compared to normotensive ones [24,25]. This study contributes to previous experiences by comparing LVMI of children with WCH to that of

children with normotension and primary hypertension. Importantly subjects were closely matched for BMI, to rule out its independent effect on LVMI [5]. We showed that children with WCH had a mean LVMI value less than primary hypertensives but more than normotensive patients, a finding in accordance with some previous literature [5,18]. Most of the patients with WCH were overweight, which might have contributed to increased LVMI values, and we tried to omit this effect by closely matching the groups based on BMI. It was interesting to note that LVH was 35% in primary HT group, 15% in WCH, and 0% in the normotensive group. A similar study in children with normotension, HT, and WCH, matched for sex, age and BMI, showed no LVH in patients with WCH [8]. At the very beginning, 4 of the unmatched WCH subjects excluded from this study also had LVH because of obesity. On the other hand 2 of the 6 WCH patients with LVH had a BMI < 95 p which might support the hypothesis that irrespective of BMI, WCH in children may represent a pre-hypertensive state and cause organ damage.

Risk factors for primary hypertension include overweight and obesity, male sex, older age, genetic factor and dietary salt intake. Data relating hypertension in childhood to later cardiovascular events is currently lacking. Most reports have identified a strong relationship between LVH and hypertension in children [19,26]. LVH was found in 35% of patients with primary hypertension in our cohort. Although age, gender, BMI-SDS, and family history were similar in the WCH and primary HT groups, LVH was significantly higher in the primary HT group, emphasizing the importance of high ambulatory BP.

Our study has its limitations. The number of patients included to study was limited. Due to its retrospective nature we couldn't have followed up the WCH patients for development of sustained HT. Since we chose patients for primary HT and control groups after matching regarding age, gender and BMI, there is a possibility that we could have missed some cases and this might affect our results while evaluating for LVMI.

Ambulatory blood pressure monitoring is helpful in defining patients with WCH, thus avoiding the need for further testing and reducing healthcare costs. Our results suggested that WCH represented an intermediate phenotype between normotension and sustained hypertension. Left ventricular hypertrophy may also be seen in children with WCH. These findings also support the current recommendations that children with WCH should be carefully followed up for early detection of definite HT [2,27]. Children with WCH should be counseled for life-style modification, and monitored by periodic ABPMs. With this aim we repeat ABPM yearly in children with WCH.

In conclusion, we believe that WCH in children and

adolescents is not innocent and may progress to definite hypertension. Given the increasing prevalence of HT in children and adolescents, early identification is essential for prevention of possible cardiovascular morbidity and mortality.

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

Authors' Contributions

Study design: E.K.Ç.

Data analyses: F.Y, G.G, T.G, E.Ç and D.K. Writing the first draft: E.K.Ç and E.D.K.Ş.

Data interpretation, discussion, and preparation of the final manuscript: E.K.Ç, and M.B.

All authors read and approved the final manuscript.

References

- Pickering TG, Shimbo D, Haas D (2006) Ambulatory blood-pressure monitoring. *N Engl J Med* 354: 2368-2374.
- Flynn JT, Kaelber DC, Baker-Smith CM, Blowey D, Carroll AE, et al. (2017) Clinical practice guideline for screening and management of high blood pressure in children and adolescents. *Pediatrics* 140.
- Sorof JM, Portman RJ (2000) White coat hypertension in children with elevated casual blood pressure. *J Pediatr* 137: 493-497.
- Matsuoka S, Kawamura K, Honda M, Awazu M (2002) White coat effect and white coat hypertension in pediatric patients. *Pediatric Nephrol* 17: 950-953.
- Stabouli S, Kotsis V, Toumanidis S, Papamichael C, Constantopoulos A, et al. (2005) White-coat and masked hypertension in children: Association with target-organ damage. *Pediatric Nephrol* 20: 1151-1155.
- Verdecchia P (1999) White-coat hypertension in adults and children. *Blood Press Monit* 4: 175-179.
- Fagard RH, Cornelissen VA (2007) Incidence of cardiovascular events in white-coat, masked and sustained hypertension versus true normotension: A meta-analysis. *J Hypertens* 25: 2193-2198.
- Lande MB, Meagher CC, Fisher SG, Belani P, Wang H, et al. (2008) Left ventricular mass index in children with white coat hypertension. *J Pediatr* 153: 50-54.
- Litwin M, Niemirska A, Ruzicka M, Feber J (2009) White coat hypertension in children: Not rare and not benign? *J Am Soc Hypertens* 3: 416-423.
- Pall D, Lengyel S, Komonyi E, Molnar C, Paragh G, et al. (2011) Impaired cerebral vasoreactivity in white coat hypertensive adolescents. *Eur J Neurol* 18: 584-589.
- Briasoulis A, Androulakis E, Palla M, Papageorgiou N, Tousoulis D (2016) White-coat hypertension and cardiovascular events: A meta-analysis. *J Hypertens* 34: 593-599.
- Satoh M, Asayama K, Kikuya M, Inoue R, Metoki H, et al. (2016) Long-term stroke risk due to partial white-coat or masked hypertension based on home and ambulatory blood pressure measurements: The Ohasama Study. *Hypertension* 67: 48-55.
- Wühl E, Witte K, Soergel M, Mehls O, Schaefer F, et al. (2002) Distribution of 24-h ambulatory blood pressure in children: normalized reference values and role of body dimensions. *J Hypertens* 20: 1995-2007.
- Devereux RB, Alonso DR, Lutas EM, Gottlieb GJ, Campo E, et al. (1986) Echocardiographic assessment of left ventricular hypertrophy: Comparison to necropsy findings. *Am J Cardiol* 57: 450-458.
- Khouri PR, Mitsnefes M, Daniels SR, Kimball TR (2009) Age-specific reference intervals for indexed left ventricular mass in children. *J Am Soc Echocardiogr* 22: 709-714.
- Mancia G, Bombelli M, Facchetti R, Madotto F, Quarti-Trevano F, et al. (2009) Long-term risk of sustained hypertension in white-coat or masked hypertension. *Hypertension* 54: 226-232.
- Ugajin T, Hozawa A, Ohkubo T, Asayama K, Kikuya M, et al. (2005) White-coat hypertension as a risk factor for the development of home hypertension: the Ohasama Study. *Arch Intern Med* 165: 1541-1546.
- Kavey RE, Kveslis DA, Atallah N, Smith FC (2007) White coat hypertension in childhood: Evidence for end-organ effect. *J Pediatr* 150: 491-497.
- McNiece KL, Gupta-Malhotra M, Samuels J, Bell C, Garcia K, et al. (2007) Left ventricular hypertrophy in hypertensive adolescents: Analysis of risk by 2004 National High Blood Pressure Education Program Working Group staging criteria. *Hypertension* 50: 392-395.
- Rosner B, Cook NR, Daniels S, Falkner B (2013) Childhood blood pressure trends and risk factors for high blood pressure: The NHANES experience 1988-2008. *Hypertension* 62: 247-254.
- Parker ED, Sinaiko AR, Kharbanda EO, Margolis KL, Daley MF, et al. (2016) Change in weight status and development of hypertension. *Pediatrics* 137.
- Floriarczyk T, Golabek-Dylewska M, Kucinska B, Werner B (2017) Evaluation of left ventricular function in overweight children and teenagers with arterial hypertension and white coat hypertension. *Cardiol J* 26: 343-349.
- Flynn JT, Alderman MH (2005) Characteristics of children with primary hypertension seen at a referral center. *Pediatr Nephrol* 20: 961-966.
- Mancia G, Bombelli M, Cuspidi C, Facchetti R, Grassi G (2017) Cardiovascular risk associated with white-coat hypertension: Pro side of the argument. *Hypertension* 70: 668-675.
- Banegas JR, Ruilope LM, de la Sierra A, Vinyoles E, Goostidi M, et al. (2018) Relationship between clinic and ambulatory blood-pressure measurements and mortality. *N Engl J Med* 378: 1509-1520.
- Brady TM, Fivush B, Flynn JT, Parekh R (2008) Ability of blood pressure to predict left ventricular hypertrophy in children with primary hypertension. *J Pediatr* 152: 73-78.
- Lurbe E, Agabiti-Rosei E, Cruickshank JK, Dominiczak A, Erdine S, et al. (2016) 2016 European Society of Hypertension guidelines for the management of high blood pressure in children and adolescents. *J Hypertens* 34: 1887-1920.