

## Blood Pressure Measurement in Children and Adolescents: Guidelines of High Blood Pressure Recommendations and Current Clinical Practice

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### Summary

**Objective:** To determine, in a school-based sample of children and adolescents, aged 7 to 17 years, of both genders, from public and private schools, the frequency of students previously submitted to blood pressure measurements.

**Methods:** A cross-sectional study was carried out in a population pool of randomly selected schoolchildren and adolescents from elementary and high schools. The sample was calculated based on the expected prevalence of hypertension for the age group. Data were collected through a questionnaire. Blood pressure was measured twice and hypertension was defined as mean systolic and/or diastolic blood pressure > 95th percentile. Independent variables studied were gender, age range, socioeconomic status, public/private school.

**Results:** The final sample included 1,253 students. The response rate was 97%: 1,215 students; 531 males; mean age 12.4±3 years (236 from 7 to 9 years; 638 from 10 to 14 years; 341 from 15 to 17 years). Prevalence of hypertension was 7.7%; 348 students (29%) had been previously submitted to blood pressure measurement (54% once; 35% 2 to 4 times; 11% 5 or more times). High economic status, private school and adolescent group were significantly associated to previous blood pressure measurement.

**Conclusion:** Despite the pediatric consensus statements and guideline recommendations on the importance of blood pressure measurement at every examination after 3 years of age, this practice presents a very low frequency (29%) among children and adolescents.

**Key words:** Blood pressure; child/epidemiology; adolescents/epidemiology.

### Introduction

According to the World Health Organization (WHO), Systemic Arterial Hypertension (SAH) affects 600 million people and is responsible for 7.1 million deaths annually, which corresponds to 13% of the worldwide mortality<sup>1</sup>.

In Brazil, the estimated prevalence in adults is 20%, with a correlation between SAH and 80% of stroke and 60% of ischemic heart disease cases<sup>2,3</sup>. There is uncontested clinical evidence that blood pressure decrease in hypertensive individuals is associated to reductions in morbidity and mortality caused by SAH<sup>4-12</sup>.

Despite the incorporation of complementary methods for the diagnosis of SAH into clinical practice such as the Ambulatory Monitoring of Blood Pressure (AMBp) and the Home Monitoring of Blood Pressure (HMBP)<sup>13</sup>, the measurement of blood pressure by the indirect method and the auscultation technique are still considered the standard procedure<sup>13-16</sup>.

The epidemiological studies carried out in Brazil in the

last decades have demonstrated that the prevalence of SAH in adults varies from 22.3 to 43.9% and from 0.8 to 8.2% in children and adolescents<sup>14-17</sup>.

Among the latter, the addition of blood pressure measurement to the pediatric assessment has allowed an earlier diagnosis of secondary SAH in asymptomatic individuals, as well as the diagnosis of early-onset primary SAH<sup>18</sup>, showing that the latter, which is predominant among adults, starts in childhood<sup>19-20</sup>.

Primary SAH in children and adolescents is associated to excess weight, reduced physical activity, inadequate fruit and vegetable intake and excess of sodium and alcohol intake<sup>15</sup>. As well as among adults, adolescents with established SAH develop target-organ lesions, including left ventricular hypertrophy<sup>15</sup>.

Therefore, the Brazilian Directives for Arterial Hypertension have progressively established the methods for arterial pressure measurement in children and adolescents as well as the parameters to be used in the classification of hypertensive and non-hypertensive individuals<sup>14,21-23</sup>.

Currently, the measurement of arterial hypertension is considered to be mandatory after 3 years of age, annually, or before that age when the child presents a morbid neonatal background, renal diseases or familial risk factors<sup>14</sup>.

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Manuscript received September 11, 2006; revised manuscript received November 8, 2006; accepted December 14, 2006.

Additionally, the routine measurement of blood pressure at school is also recommended<sup>14</sup>. There is, however, no evidence to date that such recommendations have been incorporated into pediatric clinical practice.

The presents study aims at identifying, in a population sample of children and adolescents, the frequency of individuals who have been previously submitted to blood pressure (BP) measurement, the number of times and where the measurement was carried out and the informed results.

## Methods

During the school year of 2001, an epidemiological observational transversal study was carried out, aiming at identifying the prevalence of cardiovascular risk factors (overweight risk, overweight, obesity, smoking, systemic arterial hypertension, and sedentarism), in a representative sample of children (7 to <10 years) and adolescents (10 to 17 years), of both genders, who attended Public Elementary and High Schools (City, State and Federal Schools) and private Elementary and High Schools in the city of Maceio, state of Alagoas, Brazil.

The results of this study, the criteria used for the calculation and selection of the sample, for the definition of the assessed variables and the informed consent for participation have been previously published<sup>24,25</sup>.

The Brazil Economical Classification Criterion (CCEB)<sup>26</sup> was chosen for the socioeconomic status classification, which allows the stratification of the population in five socioeconomic classes (from A to E) based on the interviewee's responses regarding assets, presence of maid in the family's house and degree of schooling of the head of the family. The classification score allows an inference about the mean monthly family income: social class A – R\$ 6,220. 50; social class B – R\$ 2,236.50; social class C – R\$ 927.00; social class D – R\$ 424.00 and social class E – R\$ 207.00.

As part of the investigation the students answered a structured questionnaire consisting of questions about previous BP measurements.

The questions related to this variable were: a) Has your blood pressure ever been measured before?; for those who answered affirmatively to this first question, the following questions were asked: b) How many times?; c) When was the last time your pressure was measured?; d) Where was it measured?; e) Were you told whether it was high, low or normal?

For association analyses, the sample was distributed in two

groups: A – children and adolescents who admitted having their BP previously measured; B – children and adolescents who admitted never having their BP measured until that moment. The independent variables assessed were: age range, gender, socioeconomic status, type of school.

The association analysis was carried out by Chi-square Test or Fisher's Exact Test in Association tables and the nullity hypothesis rejection level was set at 5%.

## Results

A total of 1,253 students were evaluated, of which 1,215 (97%) answered the questionnaire on the previous measurement of BP and 38 (3%) did not answer; 531 were males (43.7%) and 684 were females (56.3%), with a mean age of 12.4 ± 2.9 years. There were 236 children (7 to 9 yrs), 638 pre-adolescents (10 to 14 yrs) and 341 adolescents (15 to 17 yrs).

Among the students, 258 (21.2%) were from private schools and 957 (78.8%) were from public ones, with the latter attending state (724), city (181) and federal schools (52).

Regarding the socioeconomic status classification, it was observed that 69 students belonged to social class A (5.7%) 151 to social class B (12.4%), 333 to class C (27.4%), 548 to class D (45.1%) and 114 to class E (9.4%). For the analysis of the association of variables, classes A+B were considered jointly, as well as classes C+ D + E.

The distribution of students that had BP previously measured or not according to age range, gender, socioeconomic status and type of school is shown in Table 1. The statistical analysis showed a significant association between a previous measurement of BP and the adolescents' age range, social classes A and B and the fact that the student attended a private school (p<0.0001).

Regarding the number of times BP had been previously measured, 189 students had it measured only once (54%), 122 had 2 to 4 previous measurements (35%) and 37 had 5 or more previous measurements (11%).

As for the last time the pressure had been measured, 162 students had had it measured more than 1 year before (47%) and 186 (53%) less than 1 year before.

The Basic Health Unit was the place where 96 students (27%) had their BP measured; 57 (16%) mentioned having it measured at home, 52 (15%) during ER procedures, 47 (14%) at the pediatric clinic, 44 (13%) at school and 52 (15%) at other places such as pharmacies, for instance. Ten students

Table 1- Distribution of students that had BP previously measured or not, according to age range, gender, socioeconomic class and type of school

Had BP previously measured		Age (yrs)			Gender		Socio economical class		Type of school	
		7-9	10-14	15-17*	M	F	A+B*	C+D+E	Priv	Publ
Yes	348	44	138	166	145	203	28	2	3	27
No	867	192	500	175	386	481	258	965	65	1,158
Total	1,215	236	638	341	531	684	286	967	68	1,185

Priv= Private school; Publ=Public school. \*p<0.0001 (Chi-square test).

mentioned two places where they had their BP measured and 3 mentioned 3 places, but only the last place was recorded.

According to the BP measurement results, 240 students (69%) had been told their BP was normal, 41 (12%) had been told their BP was low, 12 (3%) had been told their BP was high and 55 (16%) did not recall this information. The BP measurements performed during the present investigation showed elevated BP in 3/12 students with a previous diagnosis of high arterial pressure, in 1/41 with a previous diagnosis of low arterial pressure, in 21/240 with a previous diagnosis of normal arterial pressure and in 3/55 who did not recall the previous BP measurement result.

## Discussion

As part of the physical examination, the BP measurement must be carried out at every medical consultation, regardless of the age range of the patient to be assessed.

A national survey carried out through questionnaires sent to clinicians, cardiologists and nephrologists in 1999, with a return of 14.1% of the questionnaires, showed that 85.8% of the clinicians referred measuring their adult patients' BP in 100% of the medical consultations<sup>27</sup>. Analyzing medical files of adult patients, at the first consultation, in 23 medical service centers of different assistential modalities in Salvador, Bahia, in 1982 and later in 1991, Lessa, Costa and Daltro verified that the BP measurement had been carried out in 18.7% and 35.9% of the consultations, respectively<sup>28</sup>.

Despite the different information sources used, the range of medical specialties and the geographical area assessed, it seems evident that, even adult patients, for whom the SAH morbimortality is well established, lack BP measurement by their physicians. This probably justifies the fact that Brazilian population studies show that 32% to 44% of our adult hypertensive individuals are unaware of their condition<sup>29-31</sup>. To date, there have not been similar studies involving the pediatric population.

In the present study, among 1,215 students, from 7 to 17 years, only 28.6% admitted having had their BP previously measured. Oliveira et al<sup>32</sup>, in a study carried out in Belo Horizonte, Minas Gerais, with 1,005 students from 6 to 18 years, reported that less than 50% had been previously submitted to BP measurement<sup>32</sup>. A study carried out in Maceio, Alagoas, by Lima & Rivera<sup>33</sup>, through questionnaires sent to 51 clinicians from 38 of the 54 Basic Health Units (BHU) of the Public Health System (SUS) showed that 94% of them did not routinely measure BP in children, 45% are unaware of the diagnostic criteria of SAH in children and adolescents and only 34% of the BHU had cuffs for these age ranges.

The previous measurement of BP occurred more frequently in adolescents than in pre-adolescents or children (49%, 22% and 19%, respectively). When analyzing the frequency of the BP measurement in pediatric emergency services in the USA, Silverman et al verified that 66% of the users had their BP measured; however, this measurement was more frequent in adolescents than in children<sup>34</sup>. The authors concluded that, despite the large variation in the frequency of BP measurement

in the different pediatric emergency services, it increased with the patient's age; it would be expected that in such services, BP measurement would be an indispensable part of all patients' assessment. During routine pediatric consultations, however, this frequency seems to be really low and must also occur more commonly in the older age ranges.

The present study also showed that 54% of the students who had previously undergone BP measurement, had it measured only once and 53% admitted that the measurement had been carried out less than a year before. These observations seem to corroborate the fact that the BP measurement is not routinely carried out in children and during the first years of adolescence.

Additionally, BP measurement was more frequently experienced by the students with a higher social status, who attended private schools.

Together, these findings show that, in our country, BP measurement is yet to be incorporated to the routine clinical pediatric assessment, generally speaking, and when it is performed, adolescents with a higher social status will be the ones who more often undergo this practice and will be able to benefit from the obtained results, regarding prevention or treatment. As for the latter, the fact that 31% of the students admitted that their BP was measured at home or another place (and not during a medical consultation) shows that, in these cases, the act of measuring BP probably did not result in any specific health intervention. This also happened with the 12 students who were told they had high BP at the time of the measurement, but were not referred to a physician as a result of the BP measurement.

The fact that SAH has a low prevalence in childhood and adolescence and also that it can be observed in asymptomatic individuals must certainly contribute to the non-incorporation of BP measurement to the routine pediatric assessment to date. Additionally, in the pediatric age range, BP measurement involves the choice of adequate cuffs for the child's/adolescent's arm, the use of growth curves for the identification of height percentile according to age and gender and the identification of BP percentiles in specific tables, which would require more equipment and more time availability than the measurement carried out in adults<sup>14-18</sup>.

Considering the incontestable and important role of the pediatrician in the primary prevention of risk factors for atherosclerosis since childhood<sup>35</sup>, the data presented here show the need for further studies on the attitudes and practices currently carried out, not only in the detection and control of SAH, but also of the other cardiovascular risk factors in young Brazilian individuals. A decisive strategy is needed to change the future of cardiovascular disease in Brazil.

**Supported by:** Fundação de Amparo à Pesquisa do Estado de Alagoas.

## Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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