

# Assessment of Medical Students' Skill for Pediatric Blood Pressure Measurement

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**Keywords.** blood pressure, education, knowledge, child

**Introduction.** The main reason for this study is regarding the importance of correct estimation, which can consequently decrease the risk of under or over estimation.

**Methods.** This was an observational analytic cross-sectional study. An online data collection tool "Google Form" was used to gather personal information and self-assessment score.

**Results.** From the 121 participants, the majority of them (76) were women. Most of the participants (33.9%) were seventh-year medical students. The results of this study showed that 100% of the participants believed that they possessed the skillset to measure BP correctly with an average self-assessment score of  $8.20 \pm 1.05$ . However, the mean total score for the participants was  $3.69 \pm 1.59$ , with only two of the participants scoring as high as 7.

**Conclusion.** The majority of participants attained low average score of correct blood pressure measurements. However, they noted high self-assessment scores before conducting the study. This disparity between reported results may show and emphasizes the importance of considering these 11 tips in the BP training courses.

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## INTRODUCTION

Hypertension (HTN) is the main cardiovascular diseases risk factor in 50% of patients suffering from coronary heart disease, and approximately 70% of those suffering from cerebrovascular problems.<sup>1-3</sup> According to the latest WHO report, by 2030, non-communicable diseases would be responsible for 70% of all deaths.<sup>4</sup> Smoking, HTN, alcohol consumption, weight gain, high blood cholesterol, lower consumption of fruits, and sodium-rich foods are the most important risk factors of CVD which have a high prevalence in Iranian population.<sup>5-7</sup> Primary prevention is the most important strategy for controlling these risk factors, therefore primary care providers should offer convenient access to new treatments and medical interventions in

an attempt to control some of these risk factors (i.e. HTN).<sup>8</sup> Previous studies have shown how even small variations in blood pressure (BP) may have a significant impact on cerebrovascular and cardiovascular risks.<sup>9</sup> This consideration further enhances the importance of accurate BP measurements.<sup>10</sup> Epidemiological studies in the developed nations indicated an increasing burden of HTN in children and adolescents.<sup>11,12</sup>

The only way to detect HTN is by measuring blood pressure correctly. Measuring BP requires the mastery of multiple skills performed simultaneously to gain an accurate measurement as stated in the latest practice guidelines.<sup>13</sup> In the first sight, BP measurement seems easy, but if clinicians do not apply the correct steps and principals<sup>14</sup>, it may cause

over or underestimated blood pressure reading. It is, therefore, critical that medical students attain mastery of this procedure during medical school when they are initially taught how to perform it.

In the limited number of studies performed on adult populations, the principals for measuring blood pressure correctly were rarely performed and despite its importance and difficulty in pediatrics, to the best of knowledge, it is lacking in childhood.

The structure of healthcare systems varies across different socio-cultural backgrounds but most BP measurements occur in primary care facilities.<sup>15-16</sup> Inadequate knowledge of correct BP measurement procedures is unlikely to improve during specialized postgraduate training or in-service courses because it is a basic clinical procedure that students are assumed to have learned in Health Science faculties.<sup>17</sup>

The Center for Disease Control and Prevention, stated that improving blood pressure (BP) control could save more lives than any other single clinical intervention.<sup>18</sup> Consequently it's natural to deduce that checking BP would be an essential clinical aptitude. An important aspect of attaining improved BP control is having it measured accurately<sup>18</sup> by a properly trained healthcare provider.<sup>10</sup> As, the latest American Academy of Pediatrics (AAP) childhood hypertension guideline, 11 tips should be considered in taking BP (detailed in materials and methods), therefore, we aimed to assess medical student's ability for pediatric blood pressure measurement skill through these 11 tips.

## MATERIALS AND METHODS

This was an observational analytic cross-sectional study conducted on 121 fourth to seventh-year medical students and residents at Guilan University of Medical Sciences from August 2019- September 2019. An online data collection tool "Google Form" was used to gather personal information. The inclusion criteria were indicated as 4<sup>th</sup> to 7<sup>th</sup> grades of medicine or residency, attendance in a BP training course and willingness to participate in this study. There was no limitation for the place and time during participation and access to the internet was the only needed item. Based on the latest AAP childhood hypertension guideline, the following 11 tips should be considered in taking BP:

1. At least five minutes of rest and absence of activity before the measurement should be

considered in Office.

2. The legs should be paralleled and not overlapping.
3. The feet should be on the ground.
4. The hand should be at the level of the heart and secured by the armchair.
5. The appropriate cuff size should be selected according to the child's size so that the length of the bladder should be 80% to 100% of the mid arm circumference and with at least a 40% width around mid-arm circumference.
6. The cuff should be put on the naked hand.
7. The child should not speak during the measurement.
8. The child should not talk with the phone during measurement, or use the toy and read the book.
9. BP should be measured in both hands or necessarily in the right hand.
10. Statement of child pressure to parents based on nomograms of 2017 AAP guideline.
11. Severe inactivity, exposure to cigarettes and use of caffeine beverages within thirty minutes before pressure assessment is prohibited.

For preventing the occurrence of bias in previous publications that assessed the knowledge of students in adults, they commonly performed multiple measurements on just one person. But based on the difficulty of pediatric BP measurement and ethical considerations, investigators believed that they should not perform multiple blood pressure measurements on just one child. To omit this obstacle, investigators decided to produce a 100-second BP measurement simulation video on a 5-year-old boy by an automated Beurer BP device. According to the above-mentioned 11 tips, in this scenario, the physician should perform 9 correct tips and neglect the 3<sup>rd</sup> and the 8<sup>th</sup> ones (*Feet on the ground* and *no talking*). This online survey was distributed on August 2019 to the 4<sup>th</sup> to 7<sup>th</sup>-year medical students who passed pediatrics' BP measurement training and pediatric residents of GUMS. Investigators informed respondents that this survey was conducted for the purpose of research and their responses were anonymous. They were asked to answer the questions in a questionnaire on "Google Form" including age, gender, and level of education. Besides, they should declare their skill for BP measurement as a 10- point self-assessment score. After completing the demographic characteristics, the 100-second video was played and respondents were asked

to list the correct and incorrect BP measurement tips. Their responses were gathered and the total score of each respondent was calculated from 11.

As it was mentioned after watching a 100-second-video, participants have to answer the questions, which may last around 10 minutes on average. Although, the duration for each participant may differ but generally, it ran until pressing the finish button by the participants. As it was an online form, there was no accessibility for supervision. But at the entrance, researchers requested participants not to use other online resources at the time of performing the test. Ethical Considerations

The ethical approval was obtained from the ethics committee of GUMS (Number: IR.GUMS.REC.1397.354, Date: 12/15/2018) and parental consent letter was taken.

### Statistical Analysis

After collecting the data and reviewing the responses based on the 11 tips on BP measurement, the total score for each person was calculated. The data were analyzed using IBM's SPSS 19. The data were reported by descriptive statistics including number, percent, mean, and standard deviation. The normalization of the data was assessed by the Kolmogorov-Smirnov test. Regarding the non-normal distribution of quantitative variables ( $P > .05$ ), Mann-Whitney U test was used.  $P$  value less than 0.05 was noted as significant.

### RESULTS

In this survey, 128 responses were received of which seven were excluded because they did not mention the history of Pediatrics' BP measurement training. The results of this study are based on 121 remaining participants. The mean age of participants in this study was  $26.75 \pm 4.40$  years. The highest and lowest age of participants was 50 and 22 years, respectively. Most of the participants (62.81%) were female. Results showed that the most of the participants (33.9%) were in the seventh year of medicine (Table 1).

Results showed that 100% of the participants believed that they had the skills to measure blood pressure. Also, in a 10 point self-assessment factor, the average self-assessment score was  $8.20 \pm 1.05$ , the lowest score was 5, and the highest score was 10. The results indicated that the mean total score

**Table 1.** Educational level of respondents

Educational Level	Number	Percent
5 <sup>th</sup>	28	23.1
6 <sup>th</sup>	19	15.7
7 <sup>th</sup>	41	33.9
General Practitioner	21	17.4
Residents	12	9.9

**Table 2.** 11 Tips of BP Assessment

11 Tips of BP Assessment	Number	Percent
Half an Hour Inactivity	17	14.50
Rest Before Getting BP	101	83.47
No Involvement (Telephone, Books, Toys)	3	7.47
No Talking	25	20.66
Parallel Alignment of the Legs	0	0
Foot on the Floor	22	18.18
Selected Hand	63	52.06
Supported Hand	69	57.02
Suitable Cuff Size	66	54.54
Cuff on the Skin	25	20.66
Pressure Normality Announcement	27	22.31

of blood pressure measurement was  $3.46 \pm 1.59$ , the lowest score was zero and the highest score was 7 by only two of the participants. In terms of 11 tips of blood pressure assessment, most of the participants reported at least five minutes of rest before measuring blood pressure which was reported in 101 cases (83.471%), and none of them noted the paralleled and not overlapping legs (Table 2).

Regarding the non-normal distribution of variables, Mann-Whitney U test noted that the significant difference in self-assessment scores in terms of gender. So that the average self-assessment score of men ( $8.47 \pm 0.97$ ) was higher than women ( $8.52 \pm 1.08$ ). Comparing total score based on sex noted that despite higher achieved scores by female ( $3.27 \pm 1.44$ ) than male ( $3.58 \pm 1.68$ ), no significant difference was noted between groups ( $P > .05$ ). Assessing students and physicians showed that a higher total score was achieved by physicians. Also, the total score of 5<sup>th</sup> and 6<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup>, 7<sup>th</sup> and physicians, and physicians and residents showed no significant difference (0.51, 0.67, 0.63, and 0.51; respectively).

### DISCUSSION

Diagnosis of HTN in clinical practice can be highly impacted by insufficient knowledge of blood pressure measurement.<sup>19</sup> In this study, assessing

the knowledge of medical students showed that all participants assume they had the skill and noted high self-assessment scores. But the achieved total score indicated the misunderstanding and highlighted the importance of correct blood pressure assessments. Rakotz *et al.* that assessed BP measurement in adults by medical students and physicians noted consistent results, they mentioned that respondents believed that they had this skill.<sup>20</sup> However, in a study by Gonzalez *et al.* among 71.1% of participants who passed the BP training course, only 51.8% reported the skill for a blood pressure check.

Assessing the reported factors in this study showed 3 as the median total score and 83.47% of participants mentioned the necessity of 5-minute rest before BP measurement. In a similar study by Rakotz *et al.*<sup>20</sup> on adults, results showed that only 1 student mentioned 11 points and the mean score was 4.1. Furthermore, they noted that 20% of participants mentioned 6 out of 11 tips. In their study, no significant relation was noted between total score with age ( $P > .05$ ), sex ( $P > .05$ ) or specialty ( $P > .05$ ).

In a study by Gazibara *et al.* which assessed 791, 4<sup>th</sup> and 6<sup>th</sup>-year-medical students, 97.5% mentioned the need for twice BP measurements. Also, 96.6% of 6<sup>th</sup>-year-students knew that physical activity before assessment would increase the BP level significantly. They noted no significant correlation between self-assessment and the total score ( $P > .05$ ).<sup>21</sup>

Besides, in a study on 242 Malaysian medical and nursing students, 16 itemed index was assessed and results showed that less than 70% of participants noted 9 items correctly. Proper patient's position (66.9%) and estimated inflation cuff pressure (66.1%) were the 2 highest reported items. They did not found significant difference between medical and nursing students and according to the results recommended that for accurate blood pressure monitoring, learning and practices to improve their knowledge are needed.<sup>22</sup> This recommendation was consistent with previous investigations, which noted the importance of training courses for accurate method of measuring blood pressure in medical, or nursing students.<sup>23-26</sup>

Regarding the results in this study and based on the importance of overestimated or underestimated BP reading which can cause health burden, it

seems that improving the level of knowledge is mandatory. Although by automatic devices, blood pressure assessment is easy, this could not eliminate the importance of the mentioned 11 tips. Therefore, according to the low level of acquired scores, considering methods to improve them is requisite. Seybert and Barton studied simulation-based learning in pharmacy students by assessing the accuracy of BP measurement and student satisfaction.<sup>27</sup> they found that student accuracy increased after each practice session, and there was agreement that patient simulation of BP monitoring would increase student ability to perform a BP assessment on a patient. This finding suggested that the overall knowledge of BP measurement did not change in later years of undergraduate training. It is possible that as the undergraduate training progresses, students focus more on other clinical subjects that do not primarily involve BP measurement. As a result, the theoretical background in relation to BP measurement tends to decrease. Therefore, it is essential that an adequate BP measurement technique is adopted during undergraduate medical training and is applied accordingly.<sup>21</sup>

## CONCLUSION

According to results, the majority of participants attained low average score of correct blood pressure measurements. However, they noted high self-assessment scores before conducting the study. This disparity between reported results may show and emphasize the importance of considering these 11 tips in the BP training courses.

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## CONFLICT OF INTEREST

Investigators declared no conflict of interest.

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