# Inaccurate BP measurements due to sphygmomanometer miscuffing.

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## Editorial

Inadequate sphygmomanometer maintenance and calibration is a cause for systematic error in BP measurements. Similarly errors in BP measurement arise when the cuff size is too small relative to the patients arm circumference (AC) or vice versa. The use of a wrong cuff size to arm circumference is one of the effective parameters that affects BP measurement accuracy [1].

Indeed, office-based studies demonstrate that undersized cuffs can overestimate BP and, conversely, that oversized cuffs can underestimate BP. The use of inappropriately sized cuffs is one of the common errors during BP measurement. With the general increase in upper-arm circumference which is due to increasing obesity among developed countries, because of the life style, the usage of standard cuffs is not appropriate for significant numbers of patients. By using undersized cuffs in obese patients, who are at high cardiovascular risk, BP measurements have been overestimated. In general an undersized cuff causes falsely high readings and an oversized cuff causes falsely low readings. Several researchers have clearly demonstrated that an undersized cuff overestimates where an oversized cuff underestimates the true BP as much as 10 to 30 mmHg. Undercuffing can lead to the over treatment of hypertension and overcuffing to its non-treatment [2].

The American Heart Association recommends that a cuff bladder width should be 40% of the arm circumference and a cuff bladder length be 80% of the arm circumference. It recommended a "Length to Width" ratio of 2:1 for cuff sizes.

Figure 1 shows a schematic of different components of a manual sphygmomanometer. Sphygmomanometers, were tested and certified according to international standard (AAMI/ANSI SP10 & ISO 81060-1,2) [3,4].

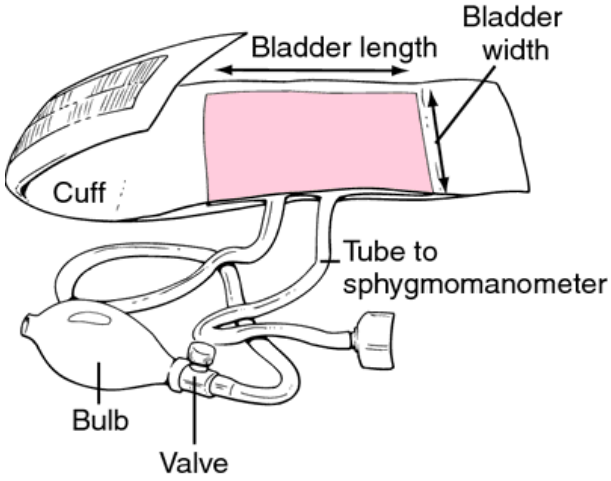


**Figure 1.** *The component of a manual sphygmomanometer.*

Generally in a cuff, the length of the bladder varied in the range of 80 mm to 400 mm and the width of the bladder had a range of 120 to 160 mm. Figuren 2 shows the length of the bladder varied in the range of arm circumference.

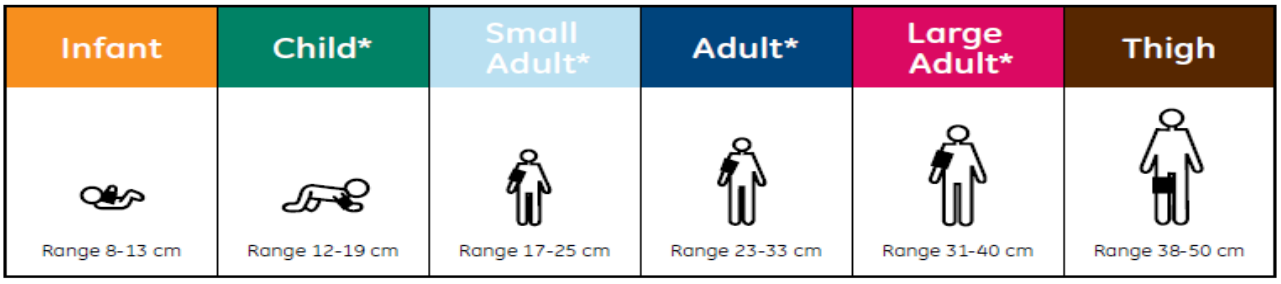


**Figure 2.** *For arm circumference: 8 to 13 mm, the cuff should be "infant"; 12 to 19 mm, the cuff should be "child"; 17 to 25 mm, the cuff should be "small adult"; 23 to 33 mm, the cuff should be "adult"; 31 to 40 mm, the cuff should be "large adult"; 38 to 50 mm, the cuff should be "adult thigh".*

As it has been shown, the practitioners should use a bigger cuff for fat arms and a smaller one for thin arms. The extent of error due to bad cuffing is variable and also relies on the cuff size. A study was conducted on this error extent which had an average error due to under cuffing of 8.5 mmHg systolic and 4.6 mmHg diastolic with wide individual variance.

In a recently study, the metrological reliability of more than two hundred manual sphygmomanometers in use were evaluated over one hundred and fifty physician's office, small public and private clinics in one of the megacity of Iran. In practice, at more than two-third office, only one cuff size was available and using a small cuff on a larger arm was the most common cause of error in blood measurement.

Furthermore, in recent years, it has been shown a rapid growing on using automated oscillometric devices especially for medical home applications and even slowly replacing office mercury sphygmomanometers with them. Home BP monitoring is recommended, in patients with mild-to-moderate masked hypertension, in order to monitor BP variations throughout the daily life and to improve treatment results. In this way, the selecting right size of cuff is very important for having an accurate measurement.

Primary care practitioners have a clinical and ethical responsibility to ensure their equipments are appropriately serviced and maintained. Moreover, the required accessories should be selected properly.

## References

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