

# Correspondence: Are Automated Blood Pressure Apparatus Reliable? Automated Versus Manual Measurement of Blood Pressure

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Dear Editor,

An interesting research article has been published in your journal, authored by Srinivasan KM et al. In the paper, the authors evaluated the “validity of aneroid and digital Blood Pressure (BP) monitors as compared to mercury manometer” [1]. We would like to share our views about the article with the journal readers.

**Research at undergraduate level:** It was our pleasure to find that the article was contributed by an undergraduate medical student. Research activity should be encouraged among undergraduate students to strengthen the future workforce in the research field. A previous study by Bains SK et al., found that though medical students are well aware of research activity (82.35%), only 19.41% actually participates in research [2]. Hope this number would be increased in near future.

**Validity and reliability:** From the title, it was evident that authors wanted to evaluate the “reliability” of automated blood pressure monitors. In the abstract of the paper, author stated that the aim was to evaluate “validity”. However, in the body text, author stated that they evaluated “accuracy and reliability”. Reliability and validity, though sometimes used interchangeably, is different from scientific and diagnostic background. “Validity” means whether the instrument (automatic BP monitor) is accurately measuring what it supposed to measure (BP). In comparison, “reliability” means the consistency in repeated measurements [3,4]. If BP is measured multiple times with a particular BP monitor, it would give same result in each time measured. Hence, authors could be more cautious about using the term “reliability” according to the nature of the study.

**Normal blood pressure cut-off:** For the study, authors recruited subject with their BP in normal range. However, authors forgot to mention the cut-off used for designating normal BP. For further analysis, it was assumed that the authors used <120/<80 (systolic over diastolic) mmHg as normal blood pressure. However, the result showed different picture. The mean systolic BP of subjects were 118.63±15.65 mmHg and diastolic BP was 77.37±9.66 mmHg. If we calculate range of systolic BP from this data, we find the highest and lowest systolic BP was 165.58 {118.63+ (15.65×3)} and 71.68 {118.63 - (15.65×3)} mmHg respectively [5,6]. This value obviously crosses the upper limit of cut-off of normal systolic BP. Maybe authors aimed to take subjects with BP within normal range; however, later had recruited subjects without checking their baseline BP.

**Best measurement:** For getting BP reading, each observer measured BP three times. Then, authors stated that they took the “best” measurement among the three readings. We think that identifying the “best” measurement was nearly impossible. Furthermore, who assessed the “best” measurement remains unanswered. To reduce inter-observer bias, merely measuring BP by three experts was not sufficient. Authors could use the average of the three measurements to reduce the bias, to some extent.

**Limitation:** The limitation of the study was written with limited words which express obscure information about the limitation of the study. We wonder why choosing a wider age range was a limitation of the study. Authors were measuring BP to compare the reading obtained by three types of instrument. Hence, the age of the subjects might not affect the study. In addition, if authors were thinking it as a limitation by any means, they could include the mean and standard deviation of age of the subjects. Furthermore, the statement - “recording was done at different times rather than being simultaneous” raised two questions.

- 1) Whether BP of a particular subject was measured multiple times at different time of the day?
- 2) Whether a subject was measured by all observers at a time of the day but a different subject at another time?

If BP of a subject was measured at different time of the day, the BP may show fluctuation physiologically. If a single subject was measured by all observers a time and measured another subject at another time of the day, it was not a limitation of the study at all.

## BP Measurement by Automated Blood Pressure Monitor

The finding of the study would help clinicians to choose the type of BP measuring instrument for their practice [1]. Measurement of BP by automated BP monitor requires several precautions. It may not be suitable for hospitals or clinics. However, considering its applicability in Home Blood Pressure Monitoring (HBPM), it may be used by patients for monitoring their own BP with proper training [7]. A list of precautions for measurement of BP by automated BP monitors has been prepared and presented in [Table/Fig-1].

| Before measurement |   |
|--------------------|---|
| •                  | Do not take tea, coffee, or caffeinated drink within 30 min |
| •                  | Do not smoke within 30 min                                  |
| •                  | Do not exercise within 30 min                               |
| •                  | Do not wear constricting clothes                            |
| •                  | Void bladder before measurement                             |
| •                  | Sit with your back straight and supported                   |
| •                  | Keep feet flat on floor, legs uncrossed                     |
| •                  | Support arm on flat surface, at the level of heart          |
| •                  | Take rest for 5 min   |
| •                  | Keep mobile phone and electronic devices away               |
| During measurement |   |
| •                  | Do not talk or move   |
| •                  | Do not measure over clothes                                 |
| •                  | Measure 3 times with ≥ 1 min gap between measurements       |
| •                  | Calculate average of 3 readings                             |
| After measurement  |   |
| •                  | Store readings on a log sheet                               |

[Table/Fig-1]: Precautions to take before, during and after blood pressure measurement by automated blood pressure monitors.

Hope, this correspondence would help the authors and readers for a better design of the study protocols for their future studies.

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