A Cross-sectional study: Determining The Accuracy Of Blood Pressure Machines used at Tertiary Hospitals in the Copperbelt Province Of Zambia

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Presentation outline

1. Introduction and Objectives
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Introduction and Objectives

- Accurate blood pressure (BP) reading is paramount in proper diagnosis and Management of patients
- Under diagnosis of hypertensive disorders increases risk of cardiovascular complications such as strokes, myocardial infarctions, renal dysfunctions.
- A meager 5 millimeter of mercury underdiagnosis will increase the chances of having a stroke or a fatal myocardial infarction by 25% (Handler, 2009).
- Over diagnosing hypertensive disorders results in increased use of medication, with the risk of adverse side effects to the client and psychological effects which impact the future of the client and increases cost to the health care sector. (Handler, 2009)
- Early diagnosis of hypertension is the key to preventing or delaying the onset of complications (Siu et al., 2015, Krist et al., 2021).

Statement of the problem

- The removal of the mercury sphygmomanometers from hospitals has resulted in increased use of non-mercury instruments for measuring BP whose accuracy is unpredictable because these are set to give BP by approximation or inference interpretation (Muniyandi *et al.,* 2022). .
- Zambia imports BP machines and relies on certification by the exporting country to declare a BP machine as accurate. If these machines are not accurate, there is risk that people are misdiagnosed with potentially devastating outcomes
- The study was important as it explored the accuracy of the imported machines and if further calibration was needed.

Research Objectives

General Objective

To determine the accuracy of BP machines used in a tertiary hospitals to screen for blood pressure abnormalities on the Copperbelt.

Specific Objectives

1. Use hospital machines to measure 3 different BP readings and compare with against the readings on a calibrated and certified machine
2. Compare the values for statistically significant difference and thereby determine the accuracy

Methodology

Study Site : Kitwe Teaching Hospital (KTH) and Ndola Teaching Hospital (NTH).

Study Population : all accessible BP machines in use.

Study design: Cross sectional study. **Ethical clearance:** TDREC/21/01/23

Method/technique

3 BP readings were recorded with each machine and then compared with the readings from the gold standard machine. Data was collected as readings recorded from the machines.

Data Analysis method

- In first stage analysis we will be testing for frequency of machine types.
- Then second stage was testing for the individual differences in the readings and determining the variation in range of readings.
- The BP readings were split into 2 groups for the purpose of analysis. (systolic and Diastolic)
- The final step was to test the differences for statistical significance using the paired t-test
- The level of significance was set at $p \leq 0.05$ for all statistical analyses and at 95% confidence level.

Results

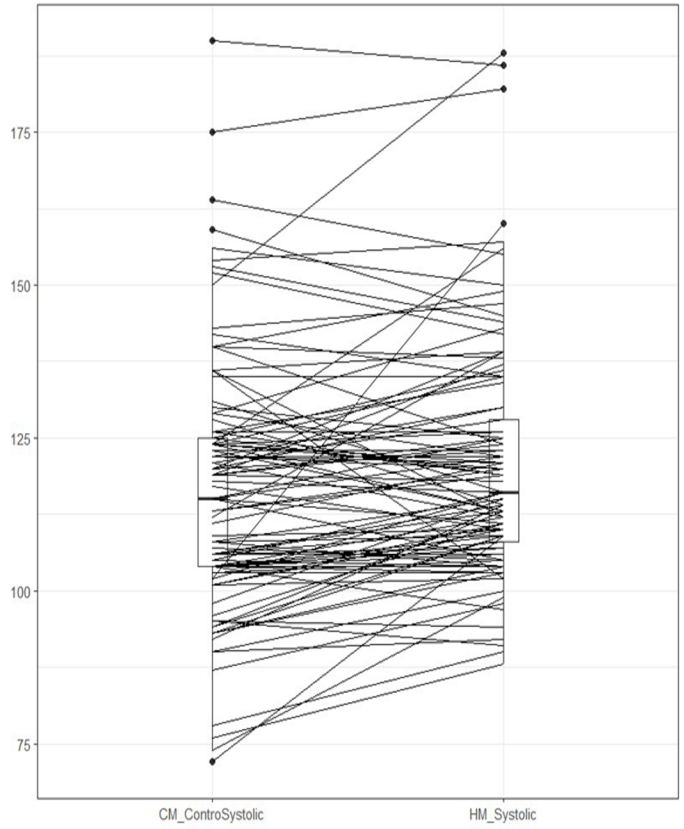
A total of 36 Blood Pressure Machines tested

13 Kitwe Teaching Hospital
23 Ndola Teaching Hospital.

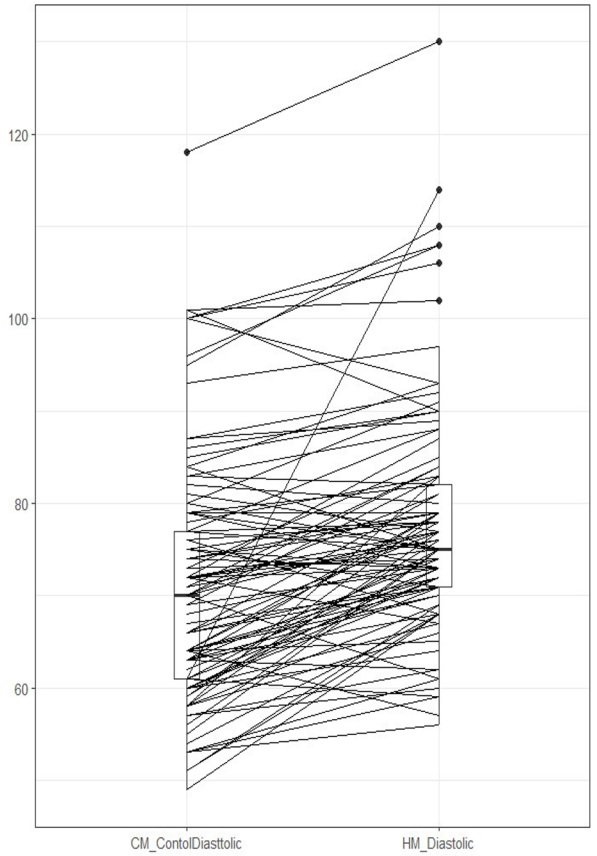
Arthur Davison Children's hospital excluded

Paired Plots- Systolic and diastolic

Systolic BP readings



Diastolic BP readings



- There was a total of 104 pairs of readings and of these 64(61%) readings that had a difference of >5mmHg) for systolic and 89 (84.8%) readings that had a difference of >2.5mmHg diastolic blood pressure difference.

Paired t-test

Systolic- Using the paired t-test, there was a significant difference in the blood pressure readings of patients taken using the calibrated machine compared to the hospital machines (paired t-test: t = -3.0634, df = 104, p = 0.003).

	Paired Difference					
	Mean	Lower	Upper	t	df	Sig.(2-tailed)(p)
Calibrated Machine Vs Hospital Machine	-3.733	-6.150	-1.317	-3.064	104	0.003

Diastolic- The paired t-test for the means showed a significant difference between the hospital machines and the calibrated machine(t=-7.88, p=0.001).

	Paired Differences(95% confidence interval)					
	mean	lower	Upper	t	df	Sig(2-tailed)
Diastolic Calibrated Machine Vs Hospital Machine	-6.63	-8.30	-4.96	-7.88	104	<0.001

Discussion and Conclusion

- There were significant differences in both systolic (paired t-test: t = -3.0634, df = 104, p = 0.003) and diastolic (t=-7.88, p=0.001). readings when hospital machines were compared to the gold standard. The inaccuracies were in the form of significantly higher or lower readings when compared to the gold standard.

- These findings correlate with other studies that machines were accurate when new but they were not rechecked after a time of use and as many as 17% of their machines in the study were inaccurate. (Coleman et al, 2005,)

- The findings raised concern as these machines are used on hundreds of people daily and the readings they give are only reliable in a few of those times.

Recommendation

- There is need to calibrate machines regularly to ensure that they give accurate BP readings to avoid costly consequences. The government must invest in the capacity of the Zambia Metrology Agency (ZMA) to calibrate the machines locally and at scale.
- Accurate machines will ensure that the public health threat posed by hypertension is mitigated for in a timely manner.

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