

Blood Pressure Measurement Techniques: Assessing Knowledge and Practice in Outpatient Settings in Tamale Teaching Hospital

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Abstract

Background

Accurate blood pressure (BP) measurement is critical to the diagnosis, classification, and management of hypertension. However, compliance with recommended blood pressure measurement techniques is still inadequate among nurses. We conducted a cross-sectional survey of outpatient department nurses' knowledge and BP measurement techniques at Tamale Teaching Hospital.

Methods

Participants were assessed while obtaining a BP reading with a sphygmomanometer by two trained assessors, and the correctness of their technique was assessed, based on World Health Organization and the European Society of Hypertension guidelines. They were then presented with a multiple-choice questionnaire to assess their knowledge of the recommendations for accurate BP measurement.

Results

A total of 30 nurses were included in the study, of whom 23 (76.7%) were female. The mean age of the participants was 29.3 ± 3.2 years, with a median (IQR) of 1 year (5 months-4.5 years) of practice. More than half of the participants (53.3%) did not receive any training on proper BP measurement techniques after leaving school. The overall compliance rate with proper BP measurement steps was 50.7%, with 40% of participants scoring below 50% on the skill assessment checklist. Participants scored poorly in areas such as enquiring about recent exercise, coffee or tea intake; enquiring whether the patient needed to empty their bladder; repeating BP measurements; checking BP in both arms and ensuring the patient had adequately rested. Participants generally performed better on the multiple-choice knowledge assessment; however, there was no correlation between skills and knowledge scores [$p(28) = -0.176, p = 0.352$].

Conclusion

Several gaps exist in nurses' skills regarding proper BP measurement in the outpatient department of Tamale Teaching Hospital. Measures, including in-service training, are needed to help translate knowledge into practice for proper BP measurement in the outpatient setting.

BACKGROUND

Hypertension is a highly prevalent modifiable risk factor for cardiovascular disease, affecting more than a quarter of the adult population in Ghana [1, 2]. Accurate blood pressure (BP) measurement is fundamental to the prompt and appropriate diagnosis and management of hypertension. It is estimated

that a 5-mmHg error in BP measurement would result in the misclassification of hypertension status for at least 84 million people worldwide [3]. Incorrect classification of hypertension status has serious health implications, including inappropriate antihypertensive drug prescription or missed diagnosis of hypertension, with devastating outcomes [3].

Office BP measurement remains the primary method of screening and diagnosing hypertension, and adequate patient preparation, positioning, and the use of an appropriate cuff size are essential to obtain accurate readings [4]. However, the knowledge, attitudes, and compliance with recommended BP techniques among health care professionals, especially nurses, are frequently suboptimal [5, 6]. Since blood pressure measurement is frequently performed by nurses, their knowledge and adherence to proper BP-measurement techniques are important for accurate diagnosis and management of hypertension in outpatient departments. This study assessed nurses' knowledge and skills in proper BP measurement in the Polyclinic and Internal Medicine outpatient departments of Tamale Teaching Hospital.

METHODS

Study design and setting

This descriptive cross-sectional study was conducted as part of a broader Human-Centered Design study aimed at improving BP measurement in the outpatient settings of the Internal Medicine and Polyclinic Departments at Tamale Teaching Hospital. The Internal Medicine Department runs an outpatient clinic from Monday to Friday, whilst the Polyclinic runs a 24-hour outpatient service daily. Data were collected in May and June 2025. Tamale Teaching Hospital is one of five public teaching hospitals in Ghana, with a bed capacity of 800, and serves as a major referral centre for northern Ghana.

Population and sampling

The study population comprised all nurses working in the outpatient clinics of the Internal Medicine and Polyclinic departments of Tamale Teaching Hospital. Student and rotation nurses were excluded. As of the time of study data collection, the Internal Medicine clinic had 15 nurses, while the Polyclinic had 30, making a total of 45 nurses in the population of interest. The nursing categories included registered general nurses, enrolled nurses, and community health nurses. Due to the small size of the population, a census approach was used in an effort to recruit all the nurses.

Study instrument

The instrument on proper BP measurement techniques was adapted from existing guidelines and literature [4, 7–10]. The instrument comprised an observational checklist and a self-administered multiple-choice questionnaire (Appendices 1 and 2). We collected demographic information, including

nursing category, highest level of education, hospital unit, years of nursing experience, and current unit of practice. Face validity was confirmed by a cardiologist and a senior nurse.

Data Collection

Data collection was conducted in two parts: (1) an assessment of BP measurement techniques during routine clinic practice, and (2) a multiple-choice questionnaire evaluating knowledge of correct BP measurement practices. In the skill assessment phase, only the unit nurse managers and two doctors were aware of the observations; participants were not informed they were being observed while performing BP measurements. Sphygmomanometers with varying cuff sizes were made available in each consulting room. Two trained assessors independently observed and evaluated the accuracy of nurses' BP measurement techniques using a standardised checklist based on the World Health Organisation (WHO)/European Society of Hypertension (ESH) guidelines (Appendix 1) [4, 10]. Scores were compared at the end of each observation, and any disagreements were resolved by repeating the assessment. Nurses who were not observed measuring BP, but whose participation was essential, were asked by the nurse manager or doctors to check a patient's BP. This request reflects routine practice familiar to nurses in the clinics.

After the skill assessment, participants were invited to take part in the knowledge test. Those who declined consent at this stage had their skill assessment forms excluded, and they were not enrolled in the study. Participants who consented were informed about the prior observation of their practice and then administered a multiple-choice questionnaire assessing knowledge of correct BP measurement techniques, based on WHO/ESH guidelines (Appendix 2) [4, 10]. During the test, participants were monitored to ensure they did not consult external sources.

Statistical analysis

The data were entered into and analysed using the Statistical Package for the Social Sciences version 21.0 software (SPSS, IBM Corporation, Armonk, NY, USA). Categorical variables were presented as counts and percentages (%), while continuous variables were summarised as means with standard deviations or medians with interquartile ranges, as appropriate. The total score for each participant was calculated and categorised as good ($\geq 75\%$), average ($50 < 75\%$), or below average ($< 50\%$). Categorical variables were compared with the Chi-square test whilst continuous variables were compared with the Student's t test or Mann-Whitney U test depending on the distribution of the data. The level of significance was set at $P < 0.05$. Spearman's rank-order correlation was performed to determine the association of skills scores with knowledge assessment scores.

RESULTS

Of an outpatient nursing population of 45, 30 participants were included in the study; 23 (76.7%) were female. Their mean age was 29.3 ± 3.2 years. The median (IQR) years of nursing practice was 1 year (5

months-4.5 years), of which 9 months (5 months-3 years) were spent in the outpatient department. Table 1 summarizes the baseline characteristics of the participants, including demographics, rank, and years of practice. More than half of the participants (53.3%) reported never receiving any training on proper BP measurement techniques after leaving school. Apart from the total number of years of practice, which was significantly longer in the polyclinic nurses, the baseline characteristics did not differ between the two groups.

Table 1
Baseline characteristics of participants

Variable	IM (n = 11)	Polyclinic (n = 19)	Total (N = 30)	Test statistic	df	p-value
Age in years (mean ± SD)	29.6 ± 2.4	29.2 ± 3.6	29.3 ± 3.2	t = 0.297	26	0.768
Gender (Female)	8	15	23	$\chi^2=0.151$	1	0.698
Years of practice	0.42 (0.42– 0.42)	3.00 (0.88– 6.00)	1.00 (0.42– 4.50)	U = 26.0 Z=-3.365		0.001*
Years in OPD	0.42 (0.42– 0.71)	1.75 (0.48– 3.75)	0.75 (0.42– 3.00)	U = 46.0 Z=-1.996		0.054
Education				$\chi^2=0.831$	2	0.660
Certificate	3	4	7			
Diploma	7	10	17			
Degree	1	4	5			
Rank				$\chi^2=3.701$	2	0.157
RGN	3	11	14			
Enrolled nurse	3	5	8			
CHN	5	3	8			
Last training on BP measurement				$\chi^2=1.509$	3	0.680
Never	6	10	16			
Within 1 year	4	5	9			
1–3 years	1	1	2			
> 3 years	0	2	2			
BP, Blood Pressure; CHN, Community Health Nurse; df, Degree of Freedom; IM, Internal Medicine; OPD, Outpatient Department; RGN, Registered General Nurse						
*Statistically significant						

Table 2 summarises participants' performance on the skills and knowledge assessment. For the BP measurement skill assessment, participants' mean score was 7.6 ± 2.3 out of 15, yielding a compliance rate of 50.7% for proper BP measurement. No participant asked about recent exercise, coffee, or tea, or

whether the patient needed to empty their bladder. Only 1 participant checked BP in both arms and separated repeated measurements by 1–2 minutes. Fewer than a quarter of participants confirmed that the patient rested for 3–5 minutes before checking BP or obtained repeated BP measurements. The mean score (out of 20) on the knowledge multiple-choice questionnaire on proper BP measurement was 13.9 ± 2.7 .

There was no significant difference in skills assessment scores between nurses in internal medicine and the polyclinic; however, nurses in internal medicine scored significantly higher on the knowledge assessment ($p < 0.05$). Appendix 3 shows participants' answering patterns for the multiple-choice questions. The correlation analysis found no significant relationship between skills and knowledge scores, $\rho(28) = -0.176, p = 0.352$.

Table 2
Performance of participants in skills and knowledge assessment

Variable	Satisfactory Performance (%)					
	IM (n = 11)	Polyclinic (n = 19)	Total (N = 30)	Test statistic	df	p value
Skill assessment questionnaire, n (%)						
Asked about smoking /coffee/tea/exercise within the last 30 minutes	0 (0.0%)	0 (0.0%)	0 (0.0%)	-	-	-
Have the patient empty the bladder when needed	0 (0.0%)	0 (0.0%)	0 (0.0%)	-	-	-
Have patient sit upright with feet flat on the floor	7 (63.6%)	12 (63.2%)	19 (63.3%)	$\chi^2=0.001$	1	0.979
Blood pressure measured with back supported	6 (54.5%)	14 (73.7%)	20 (66.7%)	$\chi^2=1.148$	1	0.284
Blood pressure measured with arm supported	10 (90.9%)	16 (84.2%)	26 (86.7%)	$\chi^2=0.271$	1	0.603
Blood pressure measured with legs uncrossed	9 (81.8%)	14 (73.7%)	23 (76.7%)	$\chi^2=0.258$	1	0.612
Removed clothing from the arm where necessary	11 (100.0%)	15 (78.9%)	26 (86.7%)	$\chi^2=2.672$	1	0.102
Blood pressure measured with arm at heart level	9 (81.8%)	16 (84.2%)	25 (83.3%)	$\chi^2=0.029$	1	0.865
Use appropriate cuff size	11 (100.0%)	17 (89.5%)	28 (93.3%)	$\chi^2=1.241$	1	0.538
Patient told to relax for 3–5 mins and not talk before BP is checked	0 (0.0%)	7 (36.8%)	7 (23.3%)	$\chi^2=5.560$	1	0.018*
Place artery mark on cuff over brachial artery	11 (100.0%)	18 (94.7%)	29 (96.7%)	$\chi^2=0.599$	1	0.439
Apply cuff on arm about 2cm above antecubital fossa and just loose enough to accommodate 1 fingerbreadth	5 (45.5%)	16 (84.2%)	21 (70.0%)	$\chi^2=4.983$	1	0.026*
Asked patient if first visit, blood pressure measured on both arms if first visit and uses higher reading	1 (9.1%)	0 (0.0%)	1 (3.3%)	$\chi^2=1.072$	1	0.300
Repeated measurements of 2–3 times	2 (18.2%)	2 (10.5%)	4 (13.3%)	$\chi^2=0.353$	1	0.552

Variable	Satisfactory Performance (%)					
	IM (n = 11)	Polyclinic (n = 19)	Total (N = 30)	Test statistic	df	p value
Skill assessment questionnaire, n (%)						
Separate repeated measurements by 1–2 minutes	0 (0.0%)	1 (5.3%)	1 (3.3%)	$\chi^2=1.713$	1	0.191
Total Skill Score (out of 15)	7.4 ± 1.6	7.7 ± 2.7	7.6 ± 2.3	t=-0.362	28	0.720
Good (≥ 75%)	0	0	0 (0.0%)	$\chi^2=1.531$	1	0.216
Average (50 to < 75%)	5 (45.5%)	13 (68.4%)	18 (60.0%)			
Below average (< 50%)	6 (54.5%)	6 (31.6%)	12 (40.0%)			
Total Knowledge score (out of 20)	15.2 ± 2.3	13.2 ± 2.6	13.9 ± 2.7	t = 2.130	28	0.042*
Good (≥ 75%)	9 (81.8%)	3 (15.8%)	12 (40.0%)	$\chi^2=12.656$	1	< 0.001*
Average (50-<75%)	2 (18.2%)	16 (84.2%)	18 (60.0%)			
Below average (< 50%)	0 (0.0%)	0 (0.0%)	0 (0.0%)			
BP, Blood Pressure; df, Degree of Freedom; IM, Internal Medicine						
*Statistically significant						

DISCUSSION

This study, the first of its kind in our institution, evaluated nurses' knowledge and skills in proper BP measurement techniques. Our data confirm that BP measurement practices among nurses in routine clinical care are generally suboptimal, with errors spanning the full spectrum of procedural steps required for accurate measurement—consistent with reports from other studies [6, 11–14].

With hypertension being a highly prevalent yet modifiable risk factor for cardiovascular disease in Ghana—affecting more than a quarter of the adult population—its diagnosis and monitoring inside healthcare settings must be treated with the utmost urgency [1]. Inaccurate BP measurement can lead to misclassification, inappropriate treatment decisions, and poor long-term control, thereby worsening the burden of cardiovascular morbidity and mortality. The errors identified—such as failing to account for recent activity, caffeine intake, or bladder fullness, and omitting repeated measurements—are known to

influence BP readings significantly [8, 10]. Addressing these deficiencies is therefore essential to improving patient outcomes.

Although participants displayed moderate knowledge of recommended techniques, their practical performance was suboptimal, with errors spanning nearly all procedural steps. These findings are consistent with reports from other settings, where discrepancies between theoretical knowledge and bedside practice have been documented [6, 11, 12]. The lack of correlation between knowledge and skills in our cohort illustrates the persistent challenge of translating guidelines into routine clinical behaviour. Awareness of correct procedures alone is insufficient to ensure accurate practice. A number of factors may contribute to this gap, including high patient workload, workflow constraints, limited supervision, absence of refresher training, and reliance on habitual shortcuts [15]. This disconnect is especially alarming given the important role of BP measurement in diagnosing and managing hypertension.

More than half of the nurses in this study reported receiving no training on BP measurement after leaving school. This highlights a critical gap in continuing professional development. Structured in-service training, competency assessments, and reinforcement of organizational procedures are urgently needed. It is important to prioritise BP measurement as a core competency, integrating it into routine audits and coaching programs. Given that this study provides baseline data for our facility, it affords an opportunity to design targeted interventions that can be scaled to other facilities in similar resource-limited contexts.

A major strength of this study is the direct observation of nurses' practice, which provides objective insights into real-world performance. However, the single-center design and relatively small sample size limit generalizability. Despite these limitations, the study presents valuable preliminary evidence that can inform institutional and national strategies.

CONCLUSION

This study demonstrates significant gaps in nurses' skills regarding accurate blood pressure measurement at Tamale Teaching Hospital, despite moderate knowledge of recommended techniques. The disconnect between knowledge and practice stresses the urgent need for structured in-service training and continuous professional development to ensure accurate diagnosis and management of hypertension. Strengthening BP measurement practices remains essential to strengthening cardiovascular care and reducing the burden of disease in Ghana.

LIST OF ABBREVIATIONS

BP Blood Pressure

CHN Community Health Nurse

ESH European Society of Hypertension

OPD Outpatient Department

RGN Registered General Nurse

WHO World Health Organisation

DECLARATIONS

Ethics approval and consent to participate

This study obtained ethics approval from the Tamale Teaching Hospital Ethics Review Committee (TTHERC/02/05/24/03). Written informed consent was obtained from all respondents in the study, and the study conformed to the principles outlined in the Declaration of Helsinki on the ethical principles for medical research involving human subjects.

Consent for publication

Not applicable

Competing interests

All authors declare no competing interests.

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Author Contribution

The study was conceptualised and designed by ASY, SPA, AWC, AGY, JA, and RL. SPA, AWC, and RL collected the data. ASY and RL entered the data. ASY performed the data analysis and drafted the initial manuscript. All authors critically reviewed, revised, and approved the final version of the manuscript.

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Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request

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