Alqalam Journal of Medical and Applied Sciences. 2025;8(3):1957-1961
https://doi.org/10.54361/ajmas.258399

Original article

Exploring Variability in Hypertension Management: Bridging the Gap Between Guidelines and Clinical Practice in Tripoli, Libya

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Abstract
Hypertension is a leading cardiovascular risk factor worldwide. Despite well-established guidelines from ESC/ESH, AHA, and NYHA, significant variability exists in clinical management, potentially affecting patient outcomes. Clinical pharmacists have a pivotal role in enhancing guideline adherence and supporting individualized therapy. To evaluate physicians' adherence to hypertension guidelines, investigate factors influencing treatment decisions, and highlight the contribution of clinical pharmacists in bridging gaps between guideline recommendations and real-world practice. A prospective cross-sectional questionnaire-based study was conducted from June to December 2024 among 80 physicians in Tripoli, Libya, across multiple healthcare centers. Data collected included demographics, guideline adherence, diagnostic and treatment practices. Statistical analyses included descriptive statistics, chi-square/Fisher-Freeman tests, Spearman's correlation, and ROC analysis to identify associations and predictors of adherence. Participants were predominantly hospital-based, with 48.8% holding bachelor's degrees. Only 31.2% of physicians adhered strictly to hypertension guidelines. Internationally recognized guidelines were the most frequently used reference (67.5%), and 53.8% employed ambulatory blood pressure monitoring (ABPM) for diagnosis. Adherence was significantly associated with patient follow-up frequency ($p<0.001$) and appropriate combination therapy decisions ($p=0.004$). Factors contributing to treatment variability included resource limitations, workload, and reliance on personal experience. Clinical pharmacists were identified as essential in supporting guideline implementation, optimizing therapy, and promoting patient-centered care. Considerable variability exists in hypertension management among physicians in Tripoli. Integrating clinical pharmacists into the healthcare team can improve adherence to evidence-based guidelines, facilitate appropriate treatment decisions, and enhance patient outcomes.
Keywords: Hypertension, Clinical Guidelines, Physician Adherence, Clinical Pharmacist.

Introduction

Hypertension is the most common modifiable cardiovascular risk factor worldwide and remains a leading cause of premature morbidity and mortality [1]. Despite advances in diagnosis and treatment, an estimated 1.28 billion adults live with hypertension, with a large proportion remaining undiagnosed or inadequately controlled [2]. Effective management of hypertension is critical to reduce the risk of stroke, myocardial infarction, heart failure, and chronic kidney disease [3].

Several international societies have developed clinical practice guidelines (CPGs) to standardize hypertension management, yet considerable variation exists among them. The 2017 American College of Cardiology/American Heart Association (ACC/AHA) guidelines lowered the diagnostic threshold for hypertension to ≥130/80 mmHg and recommended treatment targets below this level for most adults [4]. In contrast, the 2018 and 2023 European Society of Cardiology/European Society of Hypertension (ESC/ESH) guidelines define hypertension at ≥140/90 mmHg, with more individualized treatment targets—such as <130/80 mmHg for younger and high-risk patients, and <140/80 mmHg for older individuals—while emphasizing tolerance and comorbidity considerations [5,6]. Importantly, the 2023 ESH guidelines, formally endorsed by the International Society of Hypertension (ISH), introduced updates on risk stratification, out-of-office blood pressure monitoring, organ damage assessment, and the integration of newer therapeutic approaches, including renal denervation and multidisciplinary team-based care [7]. The 2024 ESC guidelines further advanced this field, highlighting lifestyle modification with stronger sodium and potassium recommendations, promoting single-pill combination therapy, and supporting digital health and pharmacist-led interventions to enhance adherence and blood pressure control [8].

Despite the availability of such evidence-based frameworks, multiple studies have demonstrated a persistent gap between guideline recommendations and real-world clinical practice. Barriers to adherence include resource limitations, lack of drug availability, patient affordability, physician workload, limited training, and skepticism regarding guideline applicability to diverse populations [9–11]. These challenges are especially pronounced in low- and middle-income countries, where physicians frequently adapt treatment plans to local realities, contributing to heterogeneity in hypertension management [12].

Within this context, the role of the clinical pharmacist has become increasingly critical. Clinical pharmacists contribute to hypertension management through medication optimization, therapeutic monitoring, patient education, and direct collaboration with physicians in evidence-based prescribing [13,14]. Evidence shows that pharmacist-led interventions improve blood pressure control rates, enhance adherence, and reduce inappropriate prescribing [15,16]. Moreover, their integration into multidisciplinary care teams addresses

***Received**: 09-07-2025 - **Accepted**: 08-09-2025 - **Published**: 13-09-2025*

key barriers to guideline implementation by ensuring cost-effective treatment selection, providing continuing education, and facilitating access to the latest recommendations [17].
Given these realities, it is essential to examine how physicians manage hypertension in daily practice and the extent to which their practices align with current guideline recommendations. This study, therefore, aimed to assess physicians' treatment approaches in hypertensive patients, evaluate adherence to international guidelines, and analyze the factors influencing clinical decision-making in a real-world setting.

Methodology

Study Design and Setting

This was a prospective cross-sectional study conducted using a structured questionnaire to evaluate physicians' awareness of hypertension guidelines and their treatment strategies. The study was carried out in Tripoli, Libya, across several healthcare facilities, including Tripoli University Hospital, Migita Military Hospital, Tajoura Heart Hospital, Al-Khadra Hospital, Tariq Al-Matar Center, and Al-Badri Center.
Physicians practicing in public health centers and actively managing hypertensive patients were approached, briefed about the study objectives, and invited to participate. A total of 80 doctors consented to participate. The study period spanned June 2024 to December 2024.

Assessment of Physicians' Knowledge and Adherence to Guidelines

Data were collected using a structured questionnaire designed to assess the participants' knowledge, attitudes, and adherence to the ESC/ESH, NYHA, and AHA guidelines regarding the diagnosis and management of hypertension. The questionnaire included the following sections: Demographic Information: Age, gender, educational background, workplace, department, and number of patients managed daily. Adherence Assessment: Multiple-choice and structured questions evaluated key aspects of guideline adherence, including diagnostic criteria, treatment protocols, and overall management strategies for hypertension.
Responses were coded numerically to allow quantification of adherence: Dichotomous questions were scored as "yes" = 1 and "no" = 0. Multiple-choice responses were classified as "correct/incorrect," "desirable/undesirable," or "high priority/low priority", as applicable.
For each participant, a composite adherence score was calculated by dividing the number of correct/desirable responses by the total number of questions in that section. Higher scores indicated stronger adherence, whereas lower scores reflected poorer compliance with guideline recommendations.

Statistical Analysis

Data were entered and analyzed using SPSS version 29.1.1 (IBM, USA). Continuous variables were tested for normality using the Shapiro-Wilk test and are presented as median ± interquartile range (IQR) if non-normally distributed. Categorical variables are summarized as frequencies and percentages.
Associations between categorical variables, including guideline adherence, treatment protocols, and workplace or department, were analyzed using the Chi-square test or Fisher-Freeman-Halton exact test where expected counts were low. For ordinal or non-normally distributed variables, Spearman's rank correlation coefficient (rho) was used to evaluate relationships between adherence scores and clinical factors such as vital organ assessment, patient-provided information, and smoking status.
To identify potential predictors of guideline adherence, an exploratory logistic regression analysis was performed. Independent variables included educational level, workplace type, years of experience, patient load, and use of ambulatory blood pressure monitoring (ABPM). Results are reported as adjusted odds ratios (OR) with 95% confidence intervals (CI). A P-value < 0.05 was considered statistically significant. Multiple comparisons were interpreted with caution to reduce the risk of type I error. ROC analysis was initially considered to assess adherence as a predictive measure; however, it was not applied since there was no external binary outcome in this study.

Results

Participant Characteristics

A total of 80 physicians participated in the study. Nearly half (48.8%) held bachelor's degrees, while the remaining participants had higher specialty qualifications ranging from diplomas to doctorates. Most physicians were employed at Tripoli University Hospital, and the average number of prescriptions dispensed daily was 18.2 ± 16.6. Daily working hours varied, with 35% working less than 6 hours, another 35% working 6–12 hours, and 30% working more than 12 hours. Participants were distributed across primary healthcare clinics (20%) and hospital outpatient clinics (45%). Regarding prescribing practices, 57.5% of physicians reported that they do not consider patients' smoking status when prescribing medications.

Adherence to Guidelines and Diagnostic Practices

Physicians demonstrated varying adherence to international guidelines. About one-third (31.2%) adhered strictly to established guidelines, while 68.8% showed partial or non-adherence. The ESC guideline was

Received*: 09-07-2025 -* ***Accepted****: 08-09-2025 -* ***Published****: 13-09-2025*

most frequently followed (35%), followed by a combination of AHA/ESC guidelines (22.5%), NYHA (11.3%), AHA (8.8%), and other guidelines (22.5%). Reliance on internationally recognized guidelines was the most common approach (67.5%), whereas 20% of physicians relied primarily on personal experience, and 8.8% followed locally adopted protocols. Ambulatory blood pressure monitoring (ABPM) was utilized by 53.8% of physicians to confirm diagnoses.

Treatment Approaches

Monotherapy was primarily prescribed for patients with uncomplicated hypertension, accounting for 80% of cases, whereas only 3.8% used monotherapy for complicated cases. Combination therapy was most often indicated for multiple reasons (57.5%), including high BP with complications (18.8%), protection from potential complications (17.5%), or severely elevated BP (6.3%). The majority of physicians reported that patients frequently returned for follow-up appointments (50%) or occasionally (43.8%), indicating a moderate level of continuity in care.

Associations Between Practices and Guideline Adherence

Several factors were associated with adherence and treatment decisions. As shown in (Table 1), adherence was higher among physicians who relied on internationally adopted guidelines and correctly identified indications for combination therapy. Patient assessment, including evaluation of vital organ function, positively correlated with adherence, while smoking status showed a negative correlation. ABPM usage varied by hospital type and working hours influenced the collection of lifestyle information. The availability of local medications also had a positive impact on adherence, highlighting the role of resource accessibility in clinical practice.

Overall, the results reveal a considerable gap between guideline recommendations and clinical practice. While most physicians reference international guidelines, actual adherence is limited. Variability in treatment approaches, diagnostic practices, and patient follow-up indicates the need for targeted interventions to improve guideline implementation and ensure consistent, evidence-based hypertension management.

Table 1. Key Associations Between Physician Practices and Guideline Adherence

Variable	Significant Finding	Statistical Measure	P-value
Guideline adherence & patient follow-up frequency	Higher adherence is associated with more frequent follow-ups	Chi-square/Fisher-Freeman	<0.001
Guideline adherence & prescribing method	Adherent physicians rely more on internationally adopted guidelines	Chi-square	0.014
Guideline adherence & combination therapy	Adherent physicians correctly identify indications for combination therapy	Chi-square	0.004
Patient assessment (vital organs) & adherence	Positive correlation with adherence	Spearman's rho = 0.275	0.013
Smoking status & adherence	Negative correlation with adherence	Spearman's rho = -0.378	<0.001
ABPM usage & hospital type	Negative correlation; some hospitals use ABPM less	Spearman's rho = -0.277	0.013
Working hours & smoking information collected	Positive correlation	Spearman's rho = 0.244	0.031
Local medication availability & adherence	Positive correlation	Spearman's rho = 0.226	0.044

Discussion

This study evaluated the gap between hypertension guidelines and real-world clinical practice among physicians, exploring factors that contribute to variability in treatment approaches. Our findings show substantial differences in how physicians manage hypertension, despite clear guideline recommendations. Most participants preferred combination therapy over monotherapy, reflecting the complexity of managing high blood pressure in patients with comorbidities or elevated cardiovascular risk. Previous studies have similarly reported that cardiologists often prescribe combination therapy for more complex cases, emphasizing the need for individualized treatment strategies [17].

The use of advanced diagnostic tools, particularly ambulatory blood pressure monitoring (ABPM), varied according to hospital resources. Hospitals with fewer resources relied less on ABPM, even though it is crucial for evaluating morning blood pressure surge and nocturnal dipping patterns, which are associated with target organ damage and cardiovascular events [18,19]. These findings highlight the importance of accurate diagnostic assessment in guiding personalized hypertension therapy.

Received*: 09-07-2025 -* ***Accepted****: 08-09-2025 -* ***Published****: 13-09-2025*

A significant reliance on physician experience was observed in prescribing hypertension treatments. Although physicians referenced international and local guidelines, adherence was inconsistent. This underscores the critical role of clinical pharmacists in bridging the gap between guidelines and practice. Pharmacists support guideline implementation by recommending evidence-based drug regimens tailored to patient comorbidities, potential drug interactions, and medication availability. They also provide patient education on lifestyle modifications and adherence, ensuring that non-pharmacologic strategies complement pharmacologic therapy [20,21].

Clinical pharmacists contribute to optimizing hypertension management by assisting with the interpretation of ABPM results, monitoring treatment effectiveness, and identifying patients at high risk for complications. Their involvement promotes standardization of care processes and collaboration with physicians and nurses, reducing variability in prescribing practices and improving patient outcomes [22–26]. In resource-limited settings, pharmacists are particularly valuable in navigating challenges such as medication shortages, limited diagnostic tools, and high patient loads, ensuring that care remains evidence-based and consistent [27,28]. Overall, our findings highlight that integrating clinical pharmacists into the healthcare team is essential for improving adherence to hypertension guidelines, optimizing therapy, and reducing cardiovascular risk. Future efforts should focus on formalizing the role of pharmacists in both primary and specialized care settings to ensure that their expertise helps close the gap between guideline recommendations and clinical practice.

Conclusion

This study highlights a substantial variability in how hypertension is managed among physicians in Tripoli, Libya, with less than one-third of respondents demonstrating strict adherence to international guidelines. Key barriers identified include resource limitations, workload pressure, and reliance on personal experience rather than evidence-based protocols. Importantly, frequent patient follow-up and the use of appropriate combination therapy were significantly associated with better compliance with recommended practices. Integrating clinical pharmacists into the healthcare team emerges as a promising strategy to bridge the gap between guidelines and real-world practice. Their role in patient counseling, medication optimization, and treatment monitoring can strengthen adherence to evidence-based standards and ultimately improve cardiovascular outcomes. Overall, our findings underscore the urgent need for targeted educational programs, structured guideline dissemination, and multidisciplinary collaboration to harmonize hypertension management in Libya with international best practices.

Conflict of interest. Nil

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Received: *09-07-2025* - ***Accepted***: *08-09-2025* - ***Published***: *13-09-2025*

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Received*: 09-07-2025 -* ***Accepted****: 08-09-2025 -* ***Published****: 13-09-2025*