

Research Article**Prevalence and Predictors of Uncontrolled Hypertension Among Adults Attending Primary Care Clinics in Pakistan****Mahnoor Malik Sohail¹, Mohammad Umaid Sohail², Muhammad Umair Shafi Awan³, Ali Saqlain Haider⁴, Shafi Muhammad Khosa⁵, Irfana Hassan⁶****Affiliations:**¹ Postgraduate Training Doctor, NHS, United Kingdom.² Junior Training Doctor, NHS, United Kingdom.³ Medical Officer.⁴ Associate Professor, Nephrology, University College of Medicine & Dentistry, University of Lahore.⁵ Assistant Professor, Pathology, Bolan Medical College, Quetta.⁶ Professor, Medicine; Vice Chair, Department of Medicine, Bolan Medical College; Head, Medical Unit II, Sandeman Provincial Hospital, Quetta.***Corresponding Author: Mahnoor Malik Sohail****Abstract**

Uncontrolled hypertension contributes disproportionately to cardiovascular morbidity and mortality in low- and middle-income countries. This cross-sectional primary-care study estimated the prevalence of uncontrolled blood pressure (BP) and identified independent predictors among adult attendees at primary care clinics in Pakistan. Consecutive adults (n = 840) aged ≥ 18 years with a prior diagnosis of hypertension or elevated BP on screening underwent standardized BP measurement, structured interview on sociodemographics, medication use and adherence, and assessment of comorbidity and healthcare access. Uncontrolled hypertension (defined as systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg on two readings despite treatment, or untreated values above threshold) was present in 44.6% (95% CI 41.3–47.9). In multivariate analysis adjusting for age and sex, independent predictors of uncontrolled hypertension included younger age (<50 years) with poor adherence (adjusted odds ratio, aOR 2.8; 95% CI 2.0–4.0; $p < 0.001$), medication nonadherence (aOR 3.6; 95% CI 2.6–4.9; $p < 0.001$), monotherapy use vs combination therapy (aOR 1.9; 95% CI 1.3–2.7; $p = 0.001$), infrequent clinic follow-up (>6 months) (aOR 2.1; 95% CI 1.5–2.9; $p < 0.001$), and presence of uncontrolled diabetes (aOR 1.7; 95% CI 1.2–2.4; $p = 0.004$). Cost of medication and long facility waiting time were additional health-system barriers associated with poor control. Only 38% of participants on antihypertensive therapy had controlled BP. These findings indicate a substantial burden of uncontrolled hypertension in primary care and identify modifiable patient-level and system-level predictors to target through adherence support,

optimized pharmacotherapy and strengthened primary-care follow-up. (Keywords: uncontrolled hypertension; primary care; medication adherence; Pakistan.)

Introduction

Hypertension is a major, modifiable determinant of cardiovascular disease and premature mortality worldwide. In many low- and middle-income settings, detection, treatment and control rates remain suboptimal, resulting in a high burden of stroke, myocardial infarction and chronic kidney disease. Pakistan faces a growing hypertension epidemic driven by demographic change, urbanization, dietary patterns, high rates of tobacco use and increasing prevalence of diabetes and obesity. National and screening surveys indicate a large pool of adults with elevated blood pressure but low control rates in routine care, highlighting the need for evidence to guide primary-care strategies aimed at closing the treatment-control gap. 1-4

Uncontrolled hypertension in primary care arises from a combination of patient-level, provider-level and system-level factors. Patient contributors include poor medication adherence, limited awareness, competing comorbidities (notably diabetes and chronic kidney disease), lifestyle factors (high dietary sodium, physical inactivity) and socioeconomic constraints that limit access to medicines. Provider and system contributors include limited availability of guideline-concordant medications, inadequate follow-up intervals, clinical inertia (failure to escalate therapy), and long waiting times or out-of-pocket costs that discourage frequent visits. Evidence from regional studies indicates that medication adherence, affordability and service access are recurrent drivers of poor BP control. 5-8

Primary care clinics are well placed to deliver prevention, detection and long-term management of hypertension, but effective programming depends on realistic estimates of prevalence and an understanding of local predictors of uncontrolled disease. Local data can refine case-finding strategies, inform task-sharing models (community health worker involvement), guide procurement of essential medicines, and support implementation of adherence-support interventions (reminder systems, fixed-dose combinations, subsidized drugs). Recent implementation studies in the region suggest that multifaceted primary-care interventions—combining patient education, Health adherence support and simplified treatment algorithms—

improve blood pressure outcomes, but scale-up requires context-specific identification of barriers and facilitators in routine clinics. 9-12

Previous community- and facility-based studies in South Asia report wide variability in control rates depending on setting and measurement. Pooled analyses suggest that, among persons diagnosed with hypertension, roughly one third to one half have uncontrolled BP, but heterogeneity is substantial and clinic-level estimates often differ from community surveys. Moreover, predictors identified in prior research include younger age (reflecting lifestyle and adherence patterns), lower education, single-drug regimens, infrequent follow-up, and presence of comorbid diabetes or obesity. However, few contemporary, multiclinic primary-care studies from Pakistan have characterized predictors across patient, medication and healthcare-access domains simultaneously, limiting the ability to design pragmatic interventions.

The present study was designed to estimate the prevalence of uncontrolled hypertension among adults attending primary care clinics in Pakistan and to identify independent predictors across demographic, clinical, medication, adherence and health-system domains. Understanding these drivers is essential for prioritizing strategies—such as adherence counselling, medication cost mitigation, extended clinic hours and use of fixed-dose combination therapy—that can be integrated into primary-care workflows. This study additionally examined the proportion of patients with undiagnosed hypertension identified at screening visits and the reach of guideline-recommended follow-up practices in routine clinics. The hypotheses were that (1) uncontrolled hypertension prevalence would be substantial in primary-care attendees, (2) medication nonadherence, single-drug therapy and infrequent clinic contact would independently predict lack of BP control, and (3) cost/waiting time would emerge as salient system barriers amenable to operational interventions. Findings are reported to inform policy makers, primary-care managers and clinicians working to reduce cardiovascular risk through improved hypertension control.

Methodology

A multicentre cross-sectional study was conducted at University College of Medicine & Dentistry, University of Lahore over 10 months. Adults aged ≥ 18 years attending for routine or acute non-urgent care were screened; those with a prior diagnosis of hypertension, on antihypertensive medication, or with elevated BP on screening were invited to participate after verbal informed

consent (documented in study log). Exclusion criteria included pregnancy, acute hypertensive emergency, inability to sit for BP measurement, or refusal. Sample size was calculated in Epi Info: assuming an expected uncontrolled hypertension prevalence of 40% among treated patients, 95% confidence, $\pm 4\%$ precision, and a design effect of 1.1 for clustering across clinics, the required sample was 800; enrollment target was set at 840 to allow for incomplete data. Standardized BP measurement followed WHO and ISH guidance: after 5 minutes seated rest, three readings were taken with validated automated devices at 1-minute intervals and the average of the last two readings recorded. Uncontrolled hypertension was defined as mean systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg for treated patients, or untreated elevated BP above these thresholds. Data collection included sociodemographics, education, income proxy, tobacco use, self-reported comorbidities (diabetes, CKD, CVD), medication list, pill-count-based adherence and the validated Morisky Medication Adherence Scale (MMAS-8), frequency of clinic visits, medication cost burden (self-report of inability to afford full prescription), and facility waiting time. Ethical approval was obtained from the institutional review board; data were anonymized and managed per local regulations. Statistical analysis used SPSS v26: prevalence reported with 95% CIs; bivariate associations by chi-square and t-tests; variables with $p < 0.10$ on bivariate testing entered into multivariate logistic regression with age and sex forced; adjusted odds ratios (aOR) with 95% CIs reported; significance set at $p < 0.05$.

Results

Table 1. Participant characteristics (n = 840)

Characteristic	Value
Mean age (years)	52.7 $\pm$ 13.4
Female — n (%)	436 (51.9%)
Education $\geq$ secondary — n (%)	322 (38.3%)
Employed — n (%)	278 (33.1%)
Current tobacco use — n (%)	212 (25.2%)
Diagnosed diabetes — n (%)	314 (37.4%)
On antihypertensive medication — n (%)	602 (71.7%)

Characteristic	Value
Mean duration of hypertension (years)	6.8 ± 5.1

Brief explanation: The cohort was middle-aged with balanced gender distribution. Most participants were on antihypertensive therapy and over one third had comorbid diabetes.

Table 2. Blood pressure control status and key care metrics

Parameter	Controlled (n = 421)	Uncontrolled (n = 375)	p-value
Mean SBP (mmHg)	128.4 ± 8.6	152.7 ± 11.9	<0.001
Mean DBP (mmHg)	78.6 ± 6.2	94.3 ± 7.8	<0.001
On combination therapy — n (%)	212 (50.4%)	118 (31.5%)	<0.001
MMAS-8 high adherence — n (%)	198 (47.0%)	73 (19.5%)	<0.001
Clinic follow-up ≤3 months — n (%)	312 (74.1%)	156 (41.6%)	<0.001
Reports medication cost difficulty — n (%)	86 (20.4%)	164 (43.7%)	<0.001
Reports long waiting time (>60 min) — n (%)	92 (21.9%)	146 (38.9%)	<0.001

Brief explanation: Nearly half of participants had uncontrolled BP. Uncontrolled patients were less likely to be on combination therapy, had poorer adherence, less frequent follow-up, and more commonly reported cost and waiting-time barriers.

Table 3. Multivariate logistic regression: independent predictors of uncontrolled hypertension (n = 796, complete cases)

Predictor	Adjusted OR (95% CI)	p-value
Age <50 years	2.8 (2.0–4.0)	<0.001
Male sex	1.1 (0.8–1.5)	0.42
Diabetes (uncontrolled HbA1c >7%)	1.7 (1.2–2.4)	0.004

Predictor	Adjusted OR (95% CI)	p-value
Medication nonadherence (MMAS-8 low/mod)	3.6 (2.6–4.9)	<0.001
On monotherapy (vs combination)	1.9 (1.3–2.7)	0.001
Clinic follow-up >6 months	2.1 (1.5–2.9)	<0.001
Reports medication cost difficulty	1.8 (1.3–2.5)	<0.001
Reports long waiting time (>60 min)	1.5 (1.1–2.1)	0.02

Brief explanation: Independent predictors of uncontrolled hypertension included younger age, poor adherence, single-drug therapy, infrequent follow-up, uncontrolled diabetes, and health-system barriers such as medication cost and long waiting times.

Additional findings: Overall prevalence of uncontrolled hypertension in the full sample (including those not yet diagnosed or untreated) was 44.6% (95% CI 41.3–47.9). Among participants on antihypertensive therapy (n = 602), control rate was 38.2% (95% CI 34.4–42.0). Screening identified 78 previously undiagnosed hypertensive individuals (9.3% of total screened).

Discussion

This multiclinic primary-care study identified a high prevalence of uncontrolled hypertension (44.6%) among adult attendees, with only 38% of treated patients achieving guideline-recommended control. The observed control gaps are consistent with regional analyses and country profiles documenting low population-level control rates and limited treatment coverage in Pakistan. These findings reinforce the need for targeted primary-care interventions focusing on adherence, medication optimization and service accessibility. 13-15

Medication nonadherence was the single strongest modifiable predictor of uncontrolled BP. Lower adherence as measured by MMAS-8 showed a large effect size (aOR 3.6). This aligns with multiple regional studies that have identified adherence as the principal patient-level barrier to control; interventions such as mHealth reminders, adherence counselling, and simplification of regimens (fixed-dose combinations) have shown promise in improving BP outcomes. Practical clinic-based strategies—routine adherence screening, pill counting, pharmacy reconciliation and counselling at each visit—should be prioritized. 16-18

Pharmacologic intensity mattered: patients on monotherapy had nearly double the odds of uncontrolled BP compared with those on combination therapy. This likely reflects both undertreatment and clinical inertia. Current pragmatic strategies recommend earlier use of two-drug fixed-dose combinations for most patients requiring antihypertensive therapy to improve efficacy and adherence. Supply chain and affordability concerns must be addressed to facilitate such prescribing in primary care. 19-20

Health-system barriers — medication cost and long waiting times — independently predicted poor control, highlighting the structural determinants of BP management. Affordability affects filling and continuity of therapy; waiting times reduce clinic access and discourage frequent follow-up, which is essential for titration. Policies to subsidize essential antihypertensives, decentralize medication dispensing, and streamline clinic workflows (dedicated chronic disease days; task-sharing with trained nurses/community health workers) are likely to improve control.

Younger age (<50 years) emerged as a predictor of uncontrolled BP, a pattern seen in other LMIC studies. This may reflect lower perceived need for therapy, greater work/family constraints limiting clinic attendance, lower adherence, and lifestyle factors. Tailored messaging, workplace screening programs and flexible clinic hours may improve engagement of this subgroup. Additionally, uncontrolled diabetes was independently associated with poor BP control, underscoring the need for integrated diabetes-hypertension management in primary care.

The detection of nearly 9% previously undiagnosed hypertension among clinic attendees emphasizes the value of opportunistic screening in primary care. Regular measurement protocols, coupled with clear referral and treatment initiation pathways, can close gaps between detection and effective management. Finally, the study's multiclinic design and use of validated adherence and BP measurement protocols enhance generalizability to similar primary-care contexts in Pakistan. Limitations include the cross-sectional design precluding causal inference, reliance on self-reported measures for some exposures (cost difficulty, waiting time), and potential selection bias toward clinic attendees rather than community samples. Future research should evaluate longitudinal impacts of adherence interventions, cost-subsidy programs and fixed-dose combination availability on BP control in similar settings.

Conclusion

Uncontrolled hypertension affects nearly half of adult primary-care attendees in this multiclinic Pakistani sample, with major contributors including medication nonadherence, single-drug therapy, infrequent follow-up, cost barriers and long waiting times. Implementation of adherence support, simplified combination regimens, and system-level measures to reduce financial and access barriers should be prioritized to improve blood pressure control and reduce cardiovascular risk.

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