



Original Article



Antihypertensive Drugs' Prescribing Pattern in Hypertensive Patients and Adherence with JNC Guidelines

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Article Information

Received 20 July 2025

Accepted 14 Sep 2025

Available online 30 Sep 2025

Keywords: Hypertension, Anti-hypertensive drugs, Thiazide Diuretics

Abstract

This study aims to investigate the prescribing patterns of antihypertensive drugs among hypertensive patients across different cities and age groups in Pakistan. Hypertension is considered to be a major public health issue, requiring effective management to prevent severe complications like cardiovascular disease and stroke (16). The study attempts to reveal that healthcare providers in Pakistan generally adhere to the established guidelines, such as the JNC 8 recommendations (12), with a particular preference for calcium channel blockers (CCBs) as the initial choice of treatment. This adherence aligns well with the guidelines, which recommend CCBs for certain populations, specifically those at high cardiovascular disease risk. However, the study also uncovers a significant underutilization of thiazide diuretics, despite their strong recommendation as a first-line therapy for hypertension. Thiazide diuretics are well-known for their efficacy, affordability, and endorsement by major guidelines; still they are not being prescribed as frequently as expected. This divergence suggests that there may be some underlying factors influencing prescriber decisions, such as local clinical practices, patient preferences, or concerns about side effects. The findings reveal the need for further investigation into these factors to better understand the reasons behind this underutilization. The research emphasizes the importance of developing personalized treatment plans that not only adhere to the latest evidence-based guidelines but also consider individual patient characteristics and local practices. By addressing these discrepancies in prescribing patterns, healthcare providers can optimize hypertension management, leading to better patient outcomes.

Introduction

Hypertension is considered as a worldwide epidemic. According to World Health Organization report, the prevalence of hypertension in the World is more than a billion and this occurs to be the most leading global risks for mortality (WHO, 2023). With advancing age, the prevalence of hypertension increases. In 2004, total 58.8 million deaths were reported worldwide, out of which, 7.5 million (12.8%) of deaths were caused by hypertension. [26] (WHO, 2009). In high-income countries it was responsible for 16.8% of deaths second to only tobacco use causing 17.9% deaths [27]. World health statistics (2012) has estimated the prevalence of hypertension to be 29.2% in males and 24.8% in females. The prevalence of hypertension is 12% and 5% for white men and women respectively who were between the age 18–49 years. However, age-related BP rise is seen more in women as compared to men. Hypertension is an increasing problem in the Pakistani population and has anticipated epidemic proportions. In one survey conducted in the two largest provinces of Pakistan in 2014–2015 (n = 7669), 50% of the adult sample had hypertension (blood pressure [BP] $\geq 140/90$ mm Hg), out of which 30% were aware of their hypertension but only 18% of patients were on medication, and the control rate was just 6%. As per the last population

based National Health Survey of Pakistan (NHSP), almost 18.9% of people in Pakistan above age of 15 years were hypertensive, with a higher prevalence in urban populations than rural population, and cases were reported in men more than women [21].

Hypertension arises from multiple interrelated factors, including genetic predisposition (with over 100 identified gene variations, particularly in the renin-angiotensin-aldosterone system), age-related arterial stiffness and increased peripheral vascular resistance, and obesity which strains cardiovascular function through elevated vascular resistance. Dietary influences such as high sodium and low potassium intake, along with insufficient fruit/vegetable consumption, significantly contribute, while obstructive sleep apnea disrupts normal oxygenation and sleep patterns to elevate blood pressure [17]. Chronic kidney disease promotes hypertension through sodium dysregulation and RAAS activation, and hormonal disorders like primary aldosteronism or Cushing's syndrome impair normal pressure regulation [2]. Certain medications (NSAIDs, decongestants) can induce hypertension, and ethnic disparities exist, with South Asian populations (including Pakistanis) showing intermediate prevalence between higher Indian and lower Bangladeshi rates in UK studies, though all groups share

similar hypertension mechanisms with Caucasian populations [28].

Uncontrolled hypertension leads to severe, potentially life-threatening complications by progressively damaging vital organs. It accelerates atherosclerosis, causing plaque buildup that narrows arteries, increasing risks of heart disease, heart failure (as the overworked heart enlarges and weakens), and stroke (from ruptured or blocked cerebral arteries). Hypertension also predisposes to aneurysms due to arterial wall weakening, kidney disease via renal vessel damage and impaired filtration, and vision loss from retinal vessel damage (hypertensive retinopathy). Additionally, it contributes to peripheral arterial disease (limb/stomach ischemia) and metabolic syndrome, a cluster of conditions elevating diabetes and cardiovascular risks. Many complications, like asymptomatic PAD or early retinopathy, develop insidiously, underscoring the need for early detection and management to prevent irreversible damage.

The JNC 8 guidelines provide evidence-based recommendations for hypertension management, emphasizing age-specific treatment thresholds and goals. For patients ≥ 60 years, pharmacologic treatment initiates at BP $\geq 150/90$ mmHg with a target of $<150/90$ mmHg, while adults <60 years and those with diabetes/CKD should start treatment at $\geq 140/90$ mmHg with the target of $<140/90$ mmHg. First-line therapy varies by population: thiazide diuretics, CCBs, ACEIs, or ARBs are recommended for non-Black patients (including diabetics), while Black patients (with/without diabetes) should begin with thiazides or CCBs. CKD patients of all races should initiate ACEIs or ARBs. The guidelines recommend a stepwise approach - first optimizing monotherapy, then adding a second drug (from recommended classes), and finally a third if needed, while avoiding concurrent ACEI/ARB use due to renal risks. These pharmacological strategies are complemented by essential modifications in lifestyle including weight management, optimizing physical activity, alcohol restraint, and smoking cessation, with regular monitoring to ensure treatment efficacy and safety.

Data collected from Karachi in 2015 reported β -blockers are found to be the most commonly used antihypertensive agent (33%), followed by angiotensin-converting enzyme [1] inhibitors (18%), calcium channel blockers (CCBs; 13%), and angiotensin receptor blockers (ARBs; 8%). (Siddique, 2020). In contrast, the Asia BP Home study, (2015) which included a broader range of patients, found that CCBs were the most used antihypertensive in Pakistan (61%), with β -blockers (49%) and ARBs (47%) also widely used [19]. The core apprehension in Pakistan is the rapidly increasing proportion of the population with hypertension (and with diabetes), which as a result is contributing to an epidemic of CVD. The medical community in general, and the PHL and Pakistan Cardiac Society (PCS) in particular, have been trying to increase the awareness of hypertension in people and government.

Methodology

This study employed a community hospital-based prescription analysis technique, focusing on a sample size of 108 patients from various cities in Pakistan. The study population was selected through a randomized stratified sampling technique from different hospitals across Abbottabad, Gujranwala, Haripur and Rawalpindi, encompassing both private and government sectors. The research was conducted as part of Clinical Pharmacy Clerkship rotations in the medical wards of Ayub Teaching Hospital Abbottabad, Chinar Hospital, and other hospital of above-mentioned cities. For this study an ethical approval for the study was obtained from the Ethical Committee of COMSATS University Islamabad, Abbottabad, with additional permissions granted by administrative officers at the participating institutions. Data collection occurred between October 2023 and March 2024. Prescriptions were analyzed for prescribing patterns of antihypertensive medications. Results were displayed as frequencies and percentages.

Results

❖ Demographics

Table 01: Gender Wise Distribution

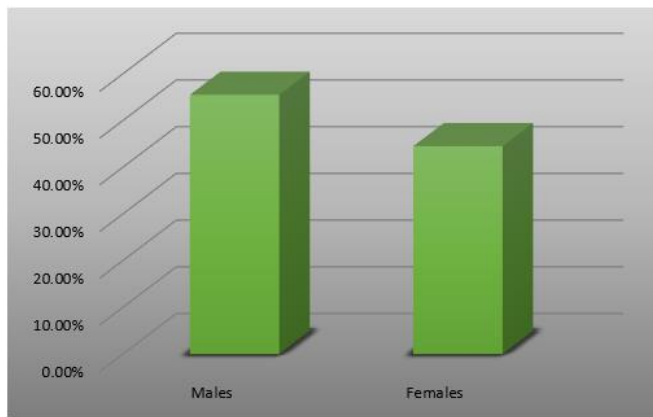
Gender	No. of Cases
Females	48
Males	60
Total	108

Description: The study comprised 108 participants, with a majority (55.5%) being male. Participants were primarily middle-aged, with the largest group (25.9%) falling within the 50-59 age range. The patients are from Gujranwala, Rawalpindi, Abbottabad and Mansehra.

Higher prevalence of hypertension in males can be due to certain reasons. Men are more likely to be exposed to and engage in unhealthy lifestyle behaviors like smoking, excessive alcohol intake, and diets with high sodium, all of these are known risk factors for hypertension [27].

Hormonal differences between males and females, particularly the protective effect of estrogen in premenopausal women, might contribute to the lower incidence of hypertension in females [15].

Figure 01: Gender Wise Distribution



❖ Age Distribution

Table 02: Age wise Distribution

Age Group	No. of Cases
≤ 19	0
20-29	6
30-39	13
40-49	22
50-59	26
60-69	28
70-79	10
≥ 80	3
Total	108

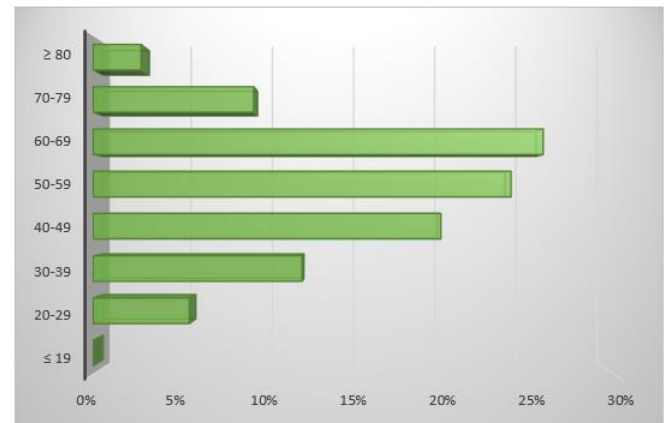
Description: Most patients (59.3%) were between 40 and 69 years old. A smaller proportion (12%) were 70 or older, and a few (8.3%) were between 20 and 39.

No patients were under 20. The study reveals a clear correlation between age and hypertension, with the highest prevalence observed in the 40-69 age groups (59.3%) [16].

With increase in age, their arteries naturally become less elastic and more rigid, leading to increased blood pressure. Over time, people may accumulate various risk factors for

hypertension, for example diabetes, obesity, and chronic kidney disease, which become more prevalent with age [5].

Figure 02: Age Wise Distribution



❖ Commonly Occurred Symptoms

Table 03: Commonly Occurred Symptoms

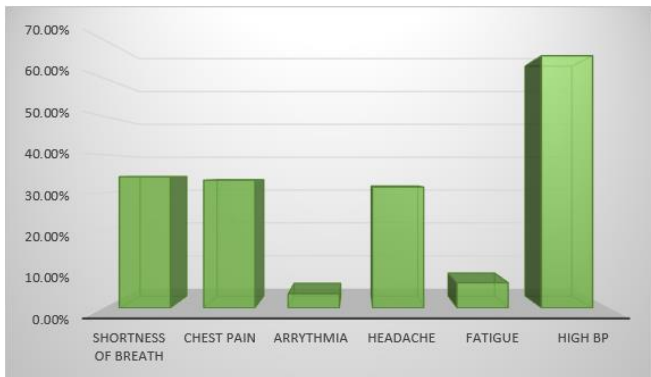
Symptoms	No. of Occurrences
SOB	37
Chest Pain	36
Arrhythmia	4
Headache	34
Fatigue	7
High BP	71
Total	108

Description: High Blood Pressure was the predominant symptom (65.7%) directly linked to the condition itself. Cardiovascular symptoms such as shortness of breath (34.2%) and chest pain (33.3%) are also prevalent, reflecting the heart's increased workload in pumping blood against elevated vascular resistance [3]. Headaches (31.5%) are frequently reported, likely due to increased pressure on brain blood vessels.

Fatigue (6.6%) may arise from the heart's reduced efficiency in circulating blood, leading to insufficient oxygen supply to tissues. Arrhythmia (3.7%), the least common symptom,

indicates irregular heartbeats, which can occur due to the heart being overworked or damaged by prolonged hypertension. These symptoms collectively highlight the systemic effects of hypertension on the body.

Figure 03: Commonly Occurred Symptoms



❖ Hypertension Ranges

Systolic Ranges

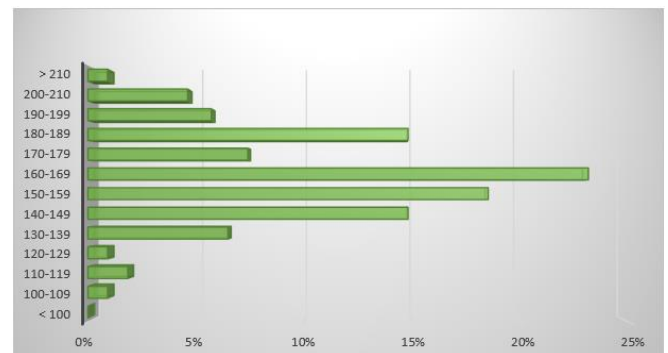
Table 04: Systolic Ranges in Hypertensive Patients

Systolic Range	Count of Systolic
< 100	0
100-109	1
110-119	2
120-129	1
130-139	7
140-149	16
150-159	20
160-169	25
170-179	8
180-189	16
190-199	6

200-210	5
> 210	1
Total	108

Description: Most patients fall within higher BP ranges, with **25 patients** in the **160-169 mmHg** range and **20 patients** in the **150-159 mmHg** range, indicating stage 2 hypertension [12]. As the systolic BP increases, the number of patients generally decreases, with **16 patients** each in the **140-149 mmHg** and **180-189 mmHg** ranges, and **8 patients** in the **170-179 mmHg** range. Only a few patients have extremely high systolic BP, with **6 patients** in the **190-199 mmHg** range, **5 patients** in the **200-210 mmHg** range, and just **1 patient** with a BP greater than **210 mmHg**. Lower BP ranges, such as **100-129 mmHg**, are less common, with only 4 patients falling into these categories, and none below 100 mmHg. This distribution emphasizes the severity of hypertension among the study population.

Figure 04: Systolic Ranges



❖ Diastolic Ranges

Table 05: Diastolic Ranges in Hypertensive Patients

Diastolic Range	Count of Diastolic
< 70	1
70-79	2
80-89	17
90-99	46
100-109	30

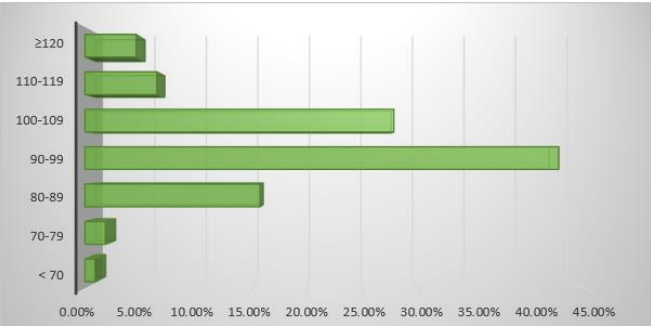
110-119	7
≥ 120	5
Total	108

Description: 42.59% of patients fall within the 90-99 mmHg range, indicating stage-1 hypertension, while 27.77% patients have even higher diastolic BP in the 100-109 mmHg range [12]. A smaller percentage (15.74%) are in the 80-89 mmHg range, at the higher end of normal or pre-hypertensive levels.

Less common are diastolic BP readings in the 110-119 mmHg (6.48%) and ≥120 mmHg (4.62%) ranges, with very few patients showing lower BP levels, such as 70-79 mmHg (1.85%) and <70 mmHg (0.92%).

This distribution highlights the prevalence of elevated diastolic BP in the patient population, pointing to widespread hypertension.

Figure 05: Diastolic Ranges



Most patients (63% had stage-2 hypertension while 28.7% had stage-1 hypertension. Only a small percentage (8.3%) had normal or elevated blood pressure [12].

The most common systolic range was 160-169 mmHg (23.1%), and the most common diastolic range was 90-99 mmHg (42.6%).

❖ Commonly Prescribed Drugs

Table 06: Most Prescribed Drugs

Drug	No. of times Prescribed
Amlodipine	44
Losartan	15

Furosemide	15
Atenolol	10
Spironolactone	7
Enalapril	6
HCTZ	5
Valsartan	3
Ramipril	3
Total	108

Description: **Amlodipine**, a calcium channel blocker (CCB), is the most prescribed drug, used by 40.7% of patients. CCBs like **Amlodipine** are often favored for their efficacy in lowering blood pressure by relaxing blood vessels [2].

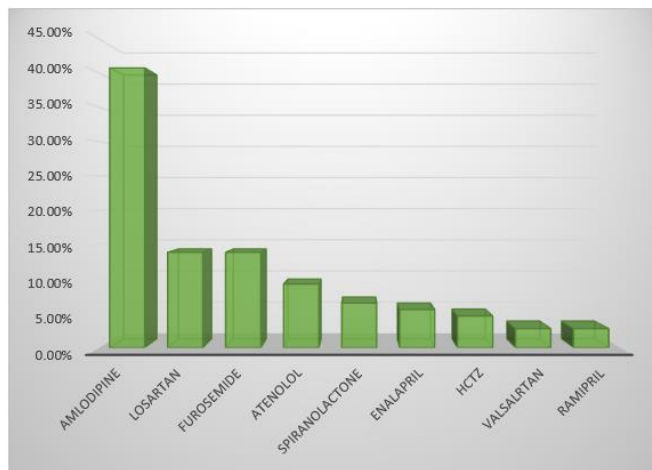
Losartan, an angiotensin II receptor blocker (ARB), and Furosemide, a loop diuretic, are both prescribed to 13.88% of patients. ARBs like Losartan work by blocking the effects of angiotensin II, it leads to vasodilation and reduced blood pressure [1], while **Furosemide** helps the kidneys remove excess fluid, decreasing blood pressure [20].

Atenolol, a beta-blocker, is prescribed to 9.25% of patients. Beta-blockers tend to reduce the heart rate and consequently lowering blood pressure. Spironolactone, is a potassium-sparing diuretic which is being prescribed to 6.48% of patients. It works by blocking aldosterone, a hormone that increases blood pressure [22].

Enalapril is an angiotensin-converting enzyme (ACE) inhibitor. It is being prescribed to 5.55% of patients, and it works by relaxing blood vessels and reducing blood volume [13]. On the other hand, HCTZ (Hydrochlorothiazide), a thiazide diuretic, prescribed to 4.62% of patients, helping the kidneys by reducing blood pressure and eliminating excess sodium and water [12].

Finally, 2.77% of patients are prescribed Valsartan, another ARB, and Ramipril, another ACE inhibitor. It demonstrates that these drug classes are used less frequently as compared to others in this patient population. This distribution reflects a different approach to hypertension management, with drug selection personalized to individual patient needs and drug requirements [25].



Figure o6: Commonly Prescribed Drugs

Discussion

❖ Participant Demographics and Gender Differences

The demographic data demonstrates a higher incidence of hypertension among males, who constitute 55.5% of the study group. This male predominance may be linked to a combination of lifestyle and biological factors. Behaviors such as smoking, heavy alcohol consumption, and high-sodium diets, are key contributors to the development of hypertension, and males are more exposed to these behaviors than women in Pakistan [27]. Additionally, hormonal differences, especially the protective effects of estrogen in premenopausal women, may explain the comparatively lower rates of hypertension in females [15]. The regional focus on areas such as Abbottabad, Gujranwala, Rawalpindi and Mansehra suggests that local healthcare practices and lifestyle factors can play a great role in these findings.

❖ Age-Related Patterns

The age distribution analysis highlights that the most of the participants (59.3%) are within the age range of 40 to 69 years. It illustrates the strong correlation between advancing age and the chances of developing hypertension [16]. With age progression, arteries become less flexible, contributing to increased blood pressure, so this trend can be attributed to age-related vascular changes as well [15]. Additionally, the presence of risk factors such as obesity, diabetes, and chronic kidney disease in older adults further exacerbates the chances of hypertension. The age associated factors of this condition are prominent as there is a recorded absence of cases among individuals under 20. These findings reveal the necessity of interventions in early lifestyle to prevent hypertension as individuals approach middle age.

❖ Prevalent Symptoms Among Participants

High blood pressure, observed in 65.7% of the study cohort, was the most reported symptom, directly associated with hypertension. Headaches, observed in 31.5% of cases, may be connected to increased intracranial pressure, while fatigue (6.6%) could be due to reduced cardiac output and impaired

oxygen delivery [3]. Cardiovascular symptoms such as shortness of breath (34.2%) and chest pain (33.3%) were also frequently reported, likely due to the increased workload on the heart in overcoming elevated vascular resistance [6]. Moreover, Arrhythmia reported in 3.7% of patients highlights the potential for hypertension to cause irregular heart rhythms over time. These symptom profiles emphasize the extensive impact of hypertension on the body, reinforcing the need for comprehensive management.

❖ Blood Pressure Levels Among Patients

A significant prevalence of stage 2 hypertension is revealed in the analysis of blood pressure measurements. 63% of patients exhibited systolic BP readings above 160 mmHg and diastolic readings above 100 mmHg [12]. These findings indicate that there is a direct need for effective treatment strategies to mitigate the risk of serious complications, including cardiovascular events and kidney disease [3,6]. The most common diastolic range was 90-99 mmHg, and the most frequent systolic range was 160-169 mmHg. This indicates a trend towards elevated blood pressure levels in this population. These results highlight the importance of monitoring routine BP and early intervention to prevent the progression of hypertension and related health issues.

❖ Medication Prescribing Trends

40.7% of participants were prescribed Amlodipine so it came out as the most frequently prescribed medication. The reason for its popularity as a treatment option may be because of its effectiveness as a calcium channel blocker [2]. Consequently, it helps to lower blood pressure by dilating the blood vessels. The prescribing rates of Losartan and Furosemide, each at 13.88%, indicate a preference for angiotensin II receptor blockers and loop diuretics in treating hypertension [1,20]. It was observed particularly in patients with additional health concerns such as heart failure or renal impairment. The less frequent use of Valsartan and Ramipril suggests that these medications are reserved for specific cases or as alternative therapies. The use of Atenolol [4], Spironolactone [22], Enalapril [13], and HCTZ [12] reveals the need for personalized treatment plans based on individual patient profiles and drug requirements. The diverse prescribing pattern underscores the importance of going for personalized medications in achieving effective blood pressure control and reducing the risk of opposing outcomes [25].

Comparison of Results with JNC Guidelines

❖ Joint National Committee

There are many research-based recommendations related to the management of HTN, which are provided by JNC 8 Guidelines. Being published in 2014, these guidelines enlist not only targets for controlling BP but also recommend different medications for different populations.

❖ Recommended Classes of Drugs

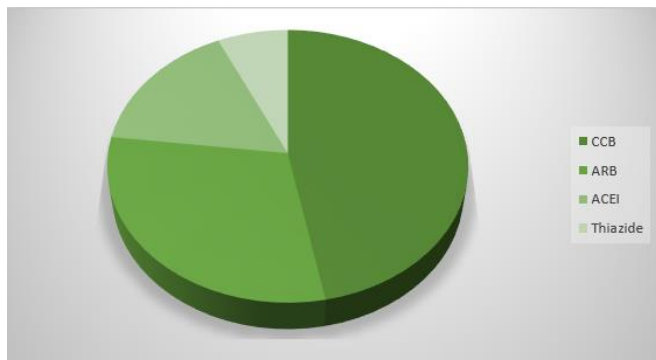
There are four main classes of antihypertensive drugs for the initial treatment, as provided by JNC 8 Guidelines. these are:

Thiazide diuretics, Calcium Channel Blockers (CCBs), Angiotensin-Converting Enzyme Inhibitors (ACEIs), or Angiotensin Receptor Blockers (ARBs). The choice of drug is affected by several factors including race, gender, presence of other chronic diseases like CKD or diabetes as well as Individual characteristics of patients.

❖ Prescribed Drugs in Data

47% of patients, being the highest percentage of sample, were prescribed calcium channel blockers (CCBs), followed by ARBs, being prescribed to 30% of patients. and then ACEIs and HCTZ which were prescribed to 16% and 7% of population, respectively.

Figure 7: Most Prescribed Drugs



Remarks

The prescribing pattern obtained from this research aligns fully with the JNC 8 guidelines for hypertension management. These guidelines recommend initiating treatment with thiazide diuretics, (CCBs), (ACEIs), or (ARBs). In this study, most patients (47%) received CCBs, followed by ARBs (30%), ACEIs (16%), and thiazide diuretics (7%). This shows that practitioners are generally following guidelines, with a preference for CCBs as the initial treatment choice. However, it also shows that the thiazide diuretics are being prescribed less, despite being a recommended first-line option, which shows the need of further research and investigation.

Limitations

This study is confined to analysis of adherence with JNC -8 guidelines only. Data was collected only from two provinces of Pakistan which may result in non-generalizability of findings; Moreover, one-point analysis (one-time prescription collection) was followed. To get more data accuracy, a larger dataset is required.

Conclusion

This study analyzed the patterns in prescription of antihypertensive drugs in hypertensive patients across various cities and people of different age groups. The findings revealed a general adherence to the established guidelines, like JNC 8 recommendations [12], for the initial treatment there is a particular focus on calcium channel blockers (CCBs). Despite

having thiazide diuretics recommended as first line option, there is an underutilization of this class. This study highlights the dire need for personalized treatment plans for patients, which incorporates the unique medicine need and characteristics of each patient [25]. The plans should include their medical history, comorbidities, ages and lifestyle. Additionally, it sheds light on the importance of aligning these treatment plans with local practices and the latest guidelines, ensuring effective management of hypertension. If discrepancies are recognized and addressed properly, healthcare providers can make more inform and effective plans leading to better recovery in diverse hypertensive patients of Pakistan. This approach not only improves the quality of care but it also aids in reducing the burden of hypertension-related complications in the region.

Conflict of Interest: NIL

Funding Sources: NIL

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Declarations:

Authors' Contribution:

^aConceptualization, and intellectual revisions

^bData collection, interpretation, and drafting of manuscript

- The authors agree to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed

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