

## Original Research Article

# Evaluation of impact of pharmaceutical care services on cardiologist adherence to hypertension Guidelines JNC 7: A critical prospect for rational use of drugs in Pakistan

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### Abstract

**Purpose:** To assess the adherence of cardiologists to JNC7 and the impact of pharmacists in reducing clinical inertia by managing high blood pressure in the cardiology out-patient department of the Armed Forces Institute of Cardiology, Rawalpindi, Pakistan.

**Methods:** This was a pre- and post-interventional prospective study in which data was abstracted from patients' history notes or prescription of selected patients at baseline and follow-up visits by applying a reliable tool. The data were abstracted again from the same patients to evaluate the cardiologists' adherence with the same parameters after 2, 4 and 6 months. The sample size for this study was 116 patients and descriptive statistics were used for categorical variables. For the comparison of cardiologist's adherence to JNC7, means and paired 't' test were used at the level of 0.05 significance.

**Results:** At baseline, the mean overall percentage of cardiologists' adherence to JNC7 was  $46.7 \pm 18.9$  %. This significantly improved to  $98.8 \pm 6.0$  % after 2 months of the pharmacist intervening by way of discussions with cardiologists. The cardiologists' adherence was further improved to 100 % after 4 and 6 months.

**Conclusion:** Improvement in cardiologists' adherence to JNC 7 guidelines and involvement of the pharmacist enhance the documentation of BP goal, lifestyle modifications and uncontrolled BP. All these helps to overcome clinical inertia that ultimately leads to better BP control and rational use of medicines.

**Keywords:** Adherence, Blood pressure control, Hypertension; Pharmaceutical care, Pharmaceutical services, Pharmaceutical interventions

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## INTRODUCTION

Despite the availability of effective drugs and practice guidelines, the control of hypertension is

far from ideal all over the world. Almost 18 % of the total general population of Pakistan is suffering from high blood pressure and every one out of three Pakistani which is above the age of

40 years is increasingly becoming prone to this disease. The situation is even worse because less than 3 % of patients have controlled BP in Pakistan. Many studies highlighted patient and physician-related factors responsible for the poor BP control. Patient-related factors include non-adherence to the medication, social-economic status and lack of access to health care. Physician-related factors are; clinician inertia (failure to intensify therapy when required), poor physician-patient relationship, lack of guidelines and disagreement with the guidelines. In the developed countries, the pharmacist has become an integral part of the health care team that improved the BP control and reduced the problems of drug interactions, non-adherence, and cost of therapy [1]. In the health care system of Pakistan, the role of the pharmacist and pharmaceutical care is not well defined and pharmacists are not providing direct patient care [2,3]. The reasons are; shortage of qualified pharmacists, lack of standard practice guidelines, insufficient training in pharmaceutical care practice and poor relationship between pharmacists and physicians. Although pharmacists are considered as health care team members, physicians are reluctant to accept their role in the health care system in Pakistan because they have poor faith and trust in the pharmacist's capabilities, concerning inpatient care due to a lack of interaction between physicians and pharmacists.

Involving clinical pharmacists in the care of hypertensive patients is one approach to improve the blood pressure control. Many physicians widely accept the idea of involving the clinical pharmacists in the care of patients suffering from variety of conditions which leads to improve patient outcomes [4]. Factors that can significantly reduce blood pressure, improve drug adherence and lifestyle modifications involve pharmacist interventions, patient counseling, pharmacotherapy planning, drug monitoring, telephone care and home visit [5,6].

There are various studies which suggest that hypertensive patients are being treated irrationally [7]. Many studies have concluded that attitude and behavior of healthcare providers towards the management of the hypertension and their deviation from the standard treatment guidelines unfold more than 66% of the poor management of the hypertension. Failure to achieve evidence-based goals which are related to blood pressure and other clinical domains maybe contributed to the clinical inertia. [8]. Presently, the control rate of hypertension in Pakistan is 12.5 %. Reasons for poor blood pressure control in Pakistan may be non-

adherence of physicians to standard treatment guidelines like JNC7 and/or clinical inertia.

The primary objective of the present study was to evaluate the impact of pharmaceutical care services provided by the pharmacist to control blood pressure of hypertensive patients in the cardiologist-pharmacist collaborative team. The secondary aim was to improve patient adherence with medication; to build the confidence of cardiologists in the pharmacist's competency in clinical care; to improve professional relationships between pharmacists and cardiologists.

## METHODS

### Study site

The study was conducted in the cardiology outpatient department (OPD) settings at the Armed Forces Institute of Cardiology (AFIC), Rawalpindi, Pakistan.

### Study design

This was a prospective pre-and post-intervention study in which the impact of a pharmacist in a cardiologist-pharmacist collaborative model to control patients' BP was evaluated for the first time in Pakistan. The pharmaceutical care interventions included assessing patients' adherence to medications; reasons for poor medication adherence and other motives of poor BP control and recommendations were thereafter provided to both patients and cardiologist to control BP. These recommendations were offered at specific intervals under the light of JNC7.

The study design specifically examined whether BP control was improved or deteriorated after interventions. In this study, the services of a clinical pharmacist were provided by the investigator of this study because these services were not available in this hospital as well as in other hospitals of the country. Assessment of patients after a specific period of 2 months, 4 months and 6 months indicates the term 'follow-up' in this study, while appointment with the healthcare professionals including doctors, nurses and pharmacists in between these follow-ups indicates the term 'visit'. Before starting the study, the principal investigator had meetings with cardiologists, discussed the study objectives and role of the pharmacist in the management of hypertensive patients as described by JNC7 [9].

The study protocol was agreed for: the selection of potential patients; pharmaceutical

interventions and recommendations to be given to both patients and cardiologists to achieve the goal. Prospective patients were referred to the pharmacist by the cardiologist. The pharmacist enrolled those patients in the study who fulfilled the eligibility criteria (Table 1) and agreed to written consent. On each visit, before consulting a cardiologist, a trained nurse recorded BP of each selected patient by using a mercury sphygmomanometer as described in the standard protocols. After consulting the cardiologist, the patient was referred to the clinical pharmacists for pharmaceutical services. For this study, 286 patients were selected randomly through convenient sampling but only 116 patients continued with the study for six months. The rest of the patients were dropped due to lack of education or loss of interest, although the medicines were provided free of cost to all patients.

**Table 1:** Eligibility criteria

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**Inclusion criteria**

Gender: Male or female, 21–85 years of age  
 Diabetic patient with clinic blood pressure values of 125/85 mmHg or Non-diabetic patient with clinic blood pressure values between 145 and 179 mmHg systolic or diastolic  
 Receiving 0-3 blood pressure control medications with insignificant change in the dose within the past 4 weeks

**Exclusion criteria**

Any evidence of hypertensive urgency or emergency or stage 3 hypertension ( $\geq 180/110$ )  
 Previously seen by the 24-h BP monitoring consult service  
 Recent stroke or MI within past 6 months before enrollment  
 New York Heart Association Class III or IV  
 Congestive Heart Failure  
 Serious hepatic or renal disease  
 Unstable angina  
 Poor prognosis with a life expectancy estimated at less than 3 years  
 Pregnancy  
 Cognitive impairment or dementia

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**Study tools**

In this model, a study questionnaire consisting of three parts was used. Demographics of the patients including name, marital status, address, gender, age, duration of hypertension, body weight, awareness to target organ damage and current visit were including in the first part of the questionnaire. However, adherence of patient to medication was measured through 8 items Morisky's medication adherence scale (MMAS) in the second part of the manuscript. The MMAS has been determined to be reliable [10]. It is associated significantly with blood pressure

control ( $p \leq 0.05$ ) in hypertensive patients [10,11]. The MMAS also has a high concordance with pharmacy fill rates [12]. This tool consists of eight questions: do you sometimes forget to take your medication any reason other than forgetfulness you missed to take your medicine; have you ever cut back or stopped taking your medication without telling your doctor, do you sometimes forget of bringing along your medication when travel; have you taken your medicine yesterday; do you sometimes stop taking your medicine when you like you are under control; do you ever feel hassled about sticking to your blood pressure treatment plan because taking medication every day is a real inconvenience for some people; how often do you have difficulty remembering to take all your medications.

The answers to the first seven questions were Yes or No, while the last question was multiple choice (never/rarely, once in a while, sometimes, usually and all the time). Assessment score given based on questions answered was '1' for 'NO' and '0' for 'YES' for the questions 1, 2, 3, 4, 6 and 7. However question 5 was not reversed. Question number 8 was adjusted with 5 options including never, once in a while, sometimes, usually and all the times. By dividing each with 4 and then subtracting the answer from 1, the score 0, 1, 2, 3, and 4 was recorded as 1, 0.75, 0.50, 0.25 and 0.00. The final score was considered as MMAS adherence score of each patient. Dividing the composite score by 8 and then multiplying by 100, the percentage adherence was calculated. The patient was considered adherent if adherence percentage was 80 % or above and non-adherent if the percentage was less than 80 % [13].

The third part was about the pharmaceutical care interventions and recommendations concerning the factors responsible for the poor BP control according to JNC7 [14]. In this section, hypertension stage of the patient, their risk factors, compelling indications, risk factors and target BP goal were documented by the pharmacist. Through questions patients who were at BP goal and adherent to the medications were identified by the pharmacist. The questions include; are the BP goals being achieved by the patient at the current visit? What is the patient's adherence score at the current visit? The patient belongs to which BP goal and medication adherence category at the current visit? There were 4 categories. Category 1 = medication adherence and Blood pressure are at control. Category 2 = Medication adherence is within the range, but blood pressure is out of range. Category 3 = medication adherence is out of the

range, but blood pressure is within the range. Category 4 = Both medication adherence and blood pressure are out of the range. The pharmacist then defined the goal value of BP for each patient (for patients with compelling indications like cardiovascular disease, diabetes, or chronic kidney disease, the BP goal value was < 130/80 mmHg and for all other patients the BP goal value was < 140/90 mmHg), assessed the patient's medication regimen and instructed the recommendations to achieve the BP goal. Some changes/alterations were also suggested by the pharmacists like; the addition of the thiazide diuretics if they are not already included in the regimen, adjusting the medication doses to the least moderate levels, selecting appropriate combinations based on the pharmacology of drugs and considering the appropriate drugs for the coexisting conditions to achieve the BP goal. If the BP is not under control, additional visits or the telephonic contact with the pharmacist were encouraged. Patients-specific recommendations and feedback to the cardiologist were based upon these interviews.

#### **Data collection**

The duration of the interview with each patient was 15 - 20 min at baseline and 10 - 15 min for follow-up visits. At baseline, the investigating pharmacist documented the patient's demographic data and blood pressure in the study questionnaire and patients' history notes. Pharmacist interviewed the patient to assess the patient's adherence and played a role in educating the patient to improve adherence and disease condition through counselling and adherence aids. The pharmacist informed the BP goal value to each patient verbally and documented it on history notes. The pharmacist offered certain recommendations to patients that will help to achieve their BP goal like; take the medicine at a given time, do not forget to take medicine, take low sodium diet or walk daily for 30 minutes. The pharmacist also suggested some recommendations to the cardiologist according to JNC 7 such as to increase or decrease in doses, changes in dose frequency, switching the drug with the same class or other class and addition of a diuretic. This information was passed verbally to cardiologists and documented as well. At follow-up visits, the investigating pharmacist documented the BP, medication adherence and recorded all the interventions and recommendations.

#### **Data analysis**

Descriptive analysis was used to compute demographic data. Percentages were expressing

categorical variables and mean  $\pm$  standard deviation were expressing continuous variables. For the comparison of means of systolic blood pressure, diastolic blood pressure and the adherence score at baseline and follow-up visits, paired t-tests and Pearson correlation were used. McNemar's chi-square test was used for dichotomous data. All statistical tests were computed on SPSS version 16.0 and p-values less than 0.05 were considered as significant.

## **RESULTS**

The details of the socio-demographic and clinical characteristics of the study group are given in Table 2. Male and female were 81(69.8 %) and 35(30.2 %) respectively while 82(70.7 %) patients were between the age group of 34 to 64 years. Most of the patients were married 106 (91.4). The awareness of hypertension was 25(21.6 %). At baseline, no risk factors were found in 27.6 % of the patients, 12.9 % patients had diabetes and family history of hypertension were found in 18.9% of the patients. Regarding target organ damage, 34.5 % had no CVS diseases, 63.8 % had angina/PCI. No compelling indications were found in 25.9 % of patients, angina/PCI were found in 46.6 % patients while blood pressure < 130/80 mmHg was found in 75 % of the patients with diabetes or chronic kidney diseases and blood pressure < 140/90 mmHg was found in 25 % of the patients with uncomplicated hypertension shown in Table 2.

### **Clinical pharmacist Interventions**

#### ***Effect on blood pressure***

In this study, the mean reduction in systolic and diastolic blood pressure was 9.9 and 6.59 mmHg respectively at the first visit after 2 months of interventions. These values were further reduced by 12.67 and 8.09 mmHg after six months (Table 3).

#### ***Morisky's medication adherence scores***

The mean of overall percentage adherence score was 82.33 ( $\pm$ 22.27) at baseline. This was increased to 99.19 ( $\pm$ 3.11) after six months. The detailed description of adherence scores at baseline and after 2, 4 and 6 months are given in Table 3.

#### ***Hypertension stages***

At baseline, 45.7 % of the patients were pre-hypertensive, 36.2 % at stage I and 18.1 % at stage II of hypertension.

**Table 2:** Sociodemographic and clinical characteristics of the study population (n = 116)

Variable	n (%)
<b>Gender</b>	
Male	81.00(69.8%)
Female	35.00(30.2%)
<b>Age</b>	
25-34 years	1.00(0.9%)
35-44 years	13.00(11.2%)
44-54 years	22.00(19.0%)
55-64 years	47.00(40.5%)
65-74 years	22.00(19.0%)
74-85 years	11.00(9.5%)
<b>Marital status</b>	
Married	106.00(91.4%)
Widowed	10.00(8.6%)
<b>History of hypertension</b>	
Less than a year	9.00(7.8%)
1-2 years	21.00(18.1%)
3-5 years	22.00(19.0%)
6-10 years	31.00(26.7%)
11-15 years	14.00(12.1%)
16-20 years	12.00(10.3%)
More than 20 years	7.00(6.0%)
<b>Awareness regarding hypertension</b>	
Aware	25.00(21.6%)
Unaware	91.00(78.4%)
<b>Risk factors</b>	
No risk factor	32.00(27.6%)
Age > 60	36.00(31.0%)
Diabetes	15.00(12.9%)
Family History (F<65; M<55)	22.00(18.9%)
Dyslipidemia	1.00(0.9%)
Obesity	1.00(0.9%)
Physical inactivity	8.00(6.9%)
Male or Postmenopausal	1.00(0.9%)
Female	1.00(0.9%)
<b>Target Organ Damage/Cardiovascular Diseases</b>	
LVH	1.00(0.9%)
Angina//PCI	74.00(63.8%)
CABG	1.00(0.9%)
No TOD or CV Disease	40.00(34.5%)
<b>Compelling Indications</b>	
Heart failure	2.00(1.7%)
Angina/PCI	54.00(46.6%)
Diabetes	12.00(10.3%)
Angina + Diabetes	18.00(15.5%)

After six months, 92.2 % of patients were pre-hypertensive, 6.9 % at stage I and 0.9 % and at stage II after pharmaceutical intervention as presented in Table 3.

#### **Patient blood pressure and medication adherence**

At baseline, 51.7 % of patients were at BP goal and 70.7 % were adherent to medication. These patients were further categorized based on their BP control and medication adherence as; 41.4 % achieved both BP and medication adherence goals (category 1), 27.6 % patients attained medication adherence, but BP goal was out of range (category 2), 11.2 % patients reached their BP goal but medication adherence of these patients were out of range (category 3), 19.8 % patients neither achieved BP goal nor adherence (category 4). After six months, blood pressure goal was achieved by almost 98.3 % of the patients, whereas the patients which were under

the preferred range (80-100%) of medication adherence comprise 97.4 %. Among these, almost 94 % of the patients belonged to category 1, 5 % of the patients belonged to category 2, no patient belonged to category 3 and 0.9 % of the patients belonged to category 4 as shown in Table 3.

#### **Antihypertensive drugs used for the management of patients' blood pressure**

At baseline, 6.9 % of the patients were taking beta-blockers (BBs), 7.7 % were on calcium channel blockers (CCBs), 6.9 % were on angiotensin-converting enzyme inhibitors (ACEIs) and 5.1 % were taking angiotensin receptor blockers (ARBs). Different combinations of antihypertensive drugs were also used like ACE + BB + CCB in 6.9 %, ARB + BB in 8.6 %, ARB + BB + DIU in 10.3 % and BB + CCB + ARB + DIU in 3.4 %.

**Table 3:** Pharmaceutical interventions

Variable		Baseline, n (%)	After two months, n (%)	After four months, n (%)	After six months, n (%)
<b>Blood pressure</b>	Mean Systolic Blood Pressure	139.43 (± 18.21)	129.48 (± 11.69)	126.38 (± 7.73)	126.76 (± 6.05)
	Mean Diastolic Blood Pressure	88.23 (± 9.98)	81.64 (± 5.55)	80.28 (± 3.84)	80.14 (± 2.21)
<b>Patient's adherence By MMAS Score</b>	Mean of percentage adherence with medication	82.33 (± 22.27)	95.53 (± 13.45)	98.65 (± 6.57)	99.19 (± 3.11)
<b>Patient's hypertension stages according to JNC 7</b>	<b>Pre-hypertension</b> (120-139/85-89)	53.00 (45.7)	95.00 (81.9)	107.00 (92.2)	107.00 (92.2)
	<b>Stage I</b> (140-159/90-99)	42.00 (36.2)	18.00 (15.5)	8.00 (6.9)	8.00 (6.9)
	<b>Stage II</b> (≥160 /≥100)	21.00 (18.1)	3.00 (2.6)	1.00 (0.9)	1.00 (0.9)
<b>Blood pressure control and adherence</b>	Is the patient's blood pressure at goal at the current visit?	60.00 (51.7)	103.00 (88.8)	114.00 (98.3)	114.00 (98.3)
	Is the patient's MMAS score is within the preferred range (80- 100 %) at the current visit?	82.00 (70.7)	104.00 (89.7)	113.00 (97.4)	113.00 (97.4)
<b>Categories of BP control and medication adherence</b>	<b>Category 1</b> Both blood pressure and medication adherence are at goal.	48.00 (41.4)	96.00 (82.8)	109.00 (94.0)	109.00 (94.0)
	<b>Category 2</b> Blood pressure is out of range but medication adherence is at goal.	32.00 (27.6)	10.00 (8.6)	6.00 (5.2)	6.00 (5.2)
	<b>Category 3</b> Blood pressure is in range but medication adherence is not a goal.	13.00 (11.2)	4.00 (3.4)	0.00 (0.0)	0.00 (0.0)
	<b>Category 4</b> Neither blood pressure nor not medication adherence is in range.	23 (19.8)	6 (5.2)	1 (0.9)	1 (0.9)

**Table 4:** Antihypertensive drugs used for the management of patient blood pressure

Antihypertensive Therapy	Baseline, n (%)	After two months, n (%)	After four Months, n (%)	After six months, n (%)
Beta Blockers (BBs)	8.00(6.9)	12.00(10.3)	12.00(10.3)	12.00(10.3)
Calcium Channel Blockers (CCBs)	9.00(7.7)	8.00(6.9)	8.00(6.9)	8.00(6.9)
ACE inhibitors (ACEIs)	8.00(6.9)	8.00(6.9)	8.00(6.9)	8.00(6.9)
Angiotensin receptor blockers (ARBs)	6.00(5.1)	8.00(6.9)	8.00(6.9)	8.00(6.9)
BB + CCB	14.00(12)	12.00(10.3)	12.00(10.3)	12.00(10.3)
BB + ACEI	10.00(8.6)	10.00(8.6)	10.00(8.6)	10.00(8.6)
CCB + ARB	9.00(7.7)	8.00(6.9)	8.00(6.9)	8.00(6.9)
ARB + BB	15.00(12.9)	15.00(12.9)	15.00(12.9)	15.00(12.9)
CCB + DIU	6.00(5.1)	5.00(4.3)	5.00(4.3)	5.00(4.3)
ARB + BB + DIU	12.00(10.3)	8.00(6.9)	8.00(6.9)	8.00(6.9)
ACEI + BB + CCB	8.00(6.9)	10.00(8.6)	10.00(8.6)	10.00(8.6)
BB+ CCB + DIU	7.00(6)	6.00(5.1)	6.00(5.1)	6.00(5.1)
BB + CCB + ARB + DIU	4.00(3.4)	6.00(5.1)	6.00(5.1)	6.00(5.1)

DIU, diuretics, ACE, angiotensin-converting enzyme

After six months, the BBs were recommended in 10.3 % of patients, CCBs in 6.9 %, ACEIs in 6.9 % and ARBs 6.9 % were used. Moreover, the percentages of different combinations were

prescribed as: ARB + BB in 12.9 %, ACE + BB + CCB in 8.6 %, ARB + BB + DIU in 6.9 % and BB + CCB + ARB + DIU in 5.1 %. In the combination therapy, most commonly used drugs were BBs, whereas CCBs were in the second position and ARBs were in the third position as shown in Table 4.

### Clinical pharmacist recommendations

The Pharmacist had suggested 37.9 % recommendations to cardiologists at baseline, which were reduced to  $\leq 1$  % after six months. These recommendations were as: change in the dosing frequency 12.9 %; switch of the drug with another class in 6.9 %; an increase in dose 5.2 % and the addition of another drug in 5.2 % at baseline. All the recommendations were accepted by the cardiologists. At baseline the BP control rate was 51.7% which after interventions of six months was improved to 98.3% as shown in Table 5.

### Lifestyle modifications

Almost 90.5 % of the patients were on low sodium diet at baseline. A low-calorie diet was being followed by 89.7 % of the patients and exercise regimen was being followed by 42.2 % of the patients. Low sodium and calorie diet was

followed by all the patients after six months and exercise regimen was being followed by 69.0 % of the total patients as shown in Table 5.

### MMAS score before and after interventions

After baseline interventions adherence scores were significantly improved and significant differences ( $p = 0.00$ ) were found between patients' medication adherence scores before and after interventions as shown in Table 6.

### Systolic, diastolic blood pressures before and after interventions

By using the paired 't' test, the differences between the systolic and diastolic blood pressure of the patient before and after interventions were analyzed. After 2, 4, and 6 months of interventions, both systolic and diastolic blood pressures were significantly decreased at  $p \leq 0.05$  as shown in Table 6.

### BP control before and after interventions

BP control was increased significantly from 45.7 % to 88.8 % ( $p \leq 0.01$ ) after two months and further increased to 98.3 % ( $p \leq 0.01$ ) after four and six months, as described in Table 7.

**Table 5:** Pharmacist recommendations to modify therapy

Variable	Baseline n (%),	After two months, n (%)	After four months, n (%)	After six months, n (%)	
<b>Recommendation</b>	Added thiazide or other diuretics	10.00(8.6)	0	0	
	Added another drug	8.00(6.8)	1.00(0.9)	0	
	Drug dose is increased	8.00(6.8)	1.00(0.9)	0	
	Drug dose is decreased	2.00(1.7)	0	0	
	Change the dose frequency	20.00(17.24)	0	0	
	Switch the drug with same class	6.00(5.1)	0	1.00(0.9)	
	Drug discontinued	0	2.00(1.7)	0	
	Switch the drug with other class	10.00(8.6)	1.00(0.9)	0	
	Total recommendations to primary care provider	64.00(55.2)	15.00(12.9)	1.00(0.9)	1.00(0.9)
	Regimen is not changed	52.00(44.8)	111.00(95.7)	115.00(99.1)	116.00(100)
<b>Lifestyle modifications</b>	Currently following a modified sodium diet	105.00(90.5)	116.00(100)	116.00(100)	
	Currently following a modified calorie diet	104.00(89.7)	115.00(99.1)	116.00(100)	
	Currently following Exercise	49.00(42.2)	73.00(62.1)	80.00(69.0)	80.00(69.0)

## DISCUSSION

Hypertension is a chronic disease that cannot be completely cured but can be managed with

proper medication and lifestyle modification. But, limited knowledge of hypertension in patients can create the misperception that this disease can be cured completely in a short duration [15].

**Table 6:** Comparison of adherence score, systolic BP, diastolic BP values and their correlations between repeated visits

Variable	t-value				R	
	Baseline vs After 2months	Baseline vs After 4months	Baseline vs After 6months	Baseline vs After 2months	Baseline vs After 4months	Baseline vs After 6months
MMAS Score	7.09 <sup>1</sup>	8.25 <sup>1</sup>	8.42 <sup>1</sup>	.458 <sup>2</sup>	.055 <sup>2</sup>	.142 <sup>3</sup>
SBP	5.91 <sup>1</sup>	7.26 <sup>1</sup>	6.93 <sup>1</sup>	.329 <sup>4</sup>	.059 <sup>4</sup>	.033 <sup>4</sup>
DBP	7.003 <sup>1</sup>	8.173 <sup>1</sup>	8.753 <sup>1</sup>	.249 <sup>4</sup>	.058 <sup>4</sup>	.013 <sup>4</sup>

SBP = systolic blood pressure; DBP = diastolic blood pressure. <sup>1</sup>Paired t-test  $p \leq 0.05$ , <sup>2</sup> $p = 0.001$ , <sup>3</sup> $p < 0.002$ , <sup>4</sup> $p < 0.01$

**Table 7:** BP control from baseline to 6 months post-intervention

Visit	Patients with BP control	McNemar's Chi-square test	
		X <sup>2</sup>	P-value
Baseline	45.7 %	-	-
After 2 months	45.7 to 88.8 %	45.7	0.000
After 4 months	45.7 to 98.3 %	57.14	0.000
After 6 months	45.7 to 98.3 %	57.14	0.000

McNemar's chi-square:  $p \leq 0.05$

However, with time patients become frustrated and de-motivated and did not meet their expectations of slowing down the progression of the diseases or completely getting rid of the disease. Patients usually start thinking about alternative therapies in the absence of disease knowledge and proper use of medication in its management that lead to non-adherence to current therapy [16]. The results of this study showed that of the studied patients, 82.33, 95.53, and 99.19 % were adherent at baseline, after 2 and 6 months respectively. Almost 48.3 % of the patients were compliant to antihypertensive therapy according to the study conducted in Aga Khan University, Karachi, Pakistan. Younger age, poor awareness and symptomatic treatment were the factors that adversely affect adherence to antihypertensive medication [17].

Based on the results of the current study, significant improvement has been shown in blood pressure control from 45.7 % to 98.3 % and 99.19 % of the hypertensive patients were adherent with the therapy after pharmaceutical care interventions. Similar findings were observed in a Nigerian study a significant change in systolic blood pressure and diastolic blood pressure of the subjective patients. After baseline pharmaceutical care interventions, 75 % achieved SBP and 69 % attained DBP control [18]. According to a study, in patients with hypertension, pharmacist intervention can significantly increase blood pressure control, disease related knowledge and medication adherence [19]. In the present study, a clinical pharmacist offered verbal recommendations for

44 (37.9 %) cases to the concerned cardiologists for change in regimen according to JNC7 and all were accepted. At baseline, the common recommendations were such as the changes in the dose frequency, switch of the drug with another class, an increase in dose and the addition of another drug in 12.9, 6.9, 5.2, and 5.2 % respectively. Moreover, only 42.2 % of patients were following the exercise plan at baseline. This percentage also improved to 69 % after six months.

All these recommendations helped the patients to improve their BP control from 45.7 % to 88.8 % and 98.3 % after 2 and 6 months respectively. These results are according to the study conducted by Von Muenster in 2008 in which BP control was improved to 89 % after pharmacist's recommendations such as increased dose in 33.3 %, and addition of new medicine in 46.4 % [20]. Most of these recommendations were made at baseline indicating that pharmacist-physician co-managed team improved BP control. Another study from the United States documented the effectiveness of a cardiologist-pharmacist collaborative team to control hypertension in patients at high risk for coronary artery disease (CAD) by using strict blood pressure goal of 130/80 mmHg and compared that group to usual care within the same clinic setting.

In this study, the mean systolic and diastolic blood pressure was reduced to 9.9 and 6.6 mmHg after 2 months and more lowered to 12.67 and 8.09 mmHg after six months. Another study from the United States showed that the mean reduction in systolic and diastolic BP was 20.7 and 9.7 mmHg in the intervention group while 6.8 and 4.5 mmHg in the control group respectively after six months [21]. While a study mentioned that a 6.0 mmHg decrease in systolic blood pressure produced a 17 % reduction in ischemic heart disease mortality and a 22 % reduction in mortality due to stroke [22].

### Limitations of the study

Clinical pharmacist services were not available in OPDs of Armed Forces Institute of Cardiology



(AFIC) as well in other major government hospitals of Pakistan. The second hurdle was to build an appropriate relationship with cardiologists in clinical settings. Furthermore, setting specific goals of therapy was crucial in any collaborative practice as in this case. The patient dropout rate was on the high side as most of the illiterate patients felt that it was a waste of time to participate in the study. Thus, only a small number of patients participated in this study. The research was not expanded to major cities of Pakistan due to insufficient funds.

## CONCLUSION

The activities of the clinical pharmacist in the collaborative care of hypertensive patients with a cardiologist lead to an improvement in the cardiologist's adherence to the JNC 7 guidelines, promotes the achievement of BP goal, lifestyle modifications and BP control. All these served to overcome clinical inertia that ultimately leads to improved BP control and rational use of medicines. Pharmacists' participation together with their specific roles is needed in patient care in the healthcare system of a country. This will aid pharmacists to understand their responsibilities and duties as well as apply their pharmaceutical knowledge in terms of patient care. Long-term healthcare schemes should be formulated by the healthcare policymakers to minimize disease-related financial burden on patients. Furthermore, pharmacists should be involved in the management of chronic diseases as is the case in developed countries.

## DECLARATIONS

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Authors acknowledge the contributions of all the participants.

### Competing interests

The authors declare that they have no competing interests with regard to this study.

### Contribution of authors

We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. Muhammad Massom Akhtar is the head of the project. He organized the team for the smooth running of this project by coordinating all the members. Akbar Waheed prepared the detailed work plan, monitoring and evaluation system, and

coordinated among the supervisors, students and the project leaders. The compilation and interpretations of the factual materials were done by the Muhammad Shahid Farooq and Rahat Shamim. Narjis Batool, Ammara Hakeem, Muhammad Umer Nadeem and Zikria Saleem coordinated the activities on this project and helped in the analysis of the results.

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