



Utilization of telepharmacy in the management of hypertension

Ivan Eduku Mozu^{a,*}, Afia Frimpomaa Asare Marfo^a, John Serbe Marfo^b, Nana Ofori Adomako^a,
Nana Kwame Ayisi-Boateng^{c,d}, Pauline Boachie-Ansah^a, Joseph Attakorah^a,
Frances Thelma Owusu-Daaku^a

^a Department of Pharmacy Practice, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

^b Department of Supply Chain and Information Systems, School of Business, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

^c University Hospital, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

^d Department of Medicine, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

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ABSTRACT

Background: Deaths due to cardiovascular diseases is on the rise, with hypertension as its most important risk factor. Effective management of hypertension, however, remains a challenge. Globally, only one in five adults with hypertension have it under control. The situation is worse in sub-Saharan Africa where hypertension prevalence is highest. Telepharmacy presents a great opportunity to enhance the way we address hypertension management. **Objectives:** This study sought to determine the effectiveness of pharmaceutical care interventions implemented through telepharmacy on medication adherence, practice of therapeutic lifestyles and overall blood pressure control among patients with hypertension. **Methods:** This was a randomized control trial conducted among individuals with hypertension recruited from two Ghanaian hospitals from May 2022 to December 2022. Patients with confirmed diagnosis of hypertension were recruited and assigned into a control or intervention group. Both groups were followed for six months with the intervention group receiving telepharmacy services in addition to standard clinical care. Outcome measures included changes in blood pressure, medication adherence, lifestyle modifications, identification and resolution of pharmaceutical care issues. **Results:** One hundred and eighteen (118) patients with hypertension were involved in the study. There was a statistically significant reduction in mean blood pressures for the intervention group after six months (Systolic-148.1 + 23.6, to 134.8 + 13.7, Diastolic- 85.8 + 9.8, to 79.5 + 8.7) ($p < 0.05$). The proportion of patients with adequately controlled blood pressure increased from 39.0% to 66.1%. There was also an increase in the mean adherence score ($p < 0.05$). The number of participants who adopted lifestyle modifications such as reducing salt consumption (89.5%) and exercising (77.2%) increased. The majority (87%) of all pharmaceutical care issues were identified and resolved over the six-month period. **Conclusion:** Telepharmacy service provided via phone calls was effective in improving the control of blood pressure. It also promoted the practice of therapeutic lifestyle modifications, medication adherence and identification of pharmaceutical care issues among patients with hypertension.

1. Introduction

Globally, cardiovascular diseases (CVD) account for an estimated 17.9 million deaths annually.¹ Hypertension is the single most important risk factor for the development of other cardiovascular diseases such as stroke and heart failure,² and it is a leading cause of mortality. Over three-quarters of CVD deaths occur in low- and middle-income countries such as Ghana. In Ghana, more than one in four adults have hypertension.³ Approximately only one in five adults with hypertension have the

condition under control.⁴ Hence, there is the need to improve the management of hypertension especially in sub-Saharan Africa where its prevalence is continually increasing.⁵ Accelerating progress toward the United Nations Sustainable Development Goal target of a one-third reduction in premature non communicable disease-related death by 2030 requires improved management of hypertension.⁶

Pharmacists can play a key role in the management of hypertension. Clinical pharmacists have been shown to complement physicians in the management of hypertension. Interventions by pharmacists are effective

* Corresponding author at: Private Mail Bag, Department of Pharmacy Practice, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

E-mail address: vanemoz@gmail.com (I.E. Mozu).

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in improving antihypertensive medication adherence and reducing blood pressure.⁷ Health education and promotion by pharmacists can also help in improving the management of hypertension.⁸ Assessment of and review of blood pressure self-monitoring, progress toward meeting blood pressure goals, medication reconciliation, and initiating non pharmacological therapy have all been widely published as effective means through which pharmacists aid in the management of hypertension.^{9,10}

Despite these positives, the management of hypertension remains largely inadequate. Several factors contribute to the poor control of blood pressure among patients with hypertension. Healthcare facilities are overburdened,¹¹ physicians and/or pharmacists are unable to spend adequate time with patients.¹² Poor collaboration between healthcare workers, limited health personnel and other socio-economic factors that prevent patients from regular reviews also affect blood pressure control adversely.¹³ Telepharmacy is an emerging area of pharmacy practice being harnessed to address these challenges to improve the management of chronic conditions such as hypertension.

Telepharmacy is the delivery of pharmaceutical care to patients using telecommunication and information technologies remotely by licensed pharmacists.¹⁴ Telepharmacy provides an avenue for patient education and adherence counselling aimed at promoting adherence. Effects of the unavailability and increased burdens on clinical pharmacists can be mitigated through telepharmacy. In rural or underserved areas where access to pharmacists may be limited, telepharmacy provides remote access to pharmacists. Pharmacists can also remotely monitor the progress of individuals with chronic conditions and provide any needed assistance even in urban settings.¹⁵ Telepharmacy services have been reported to reduce the number of adverse events among patients and enhanced collaboration among other healthcare workers.¹⁶ Although the application of telepharmacy is not new, it has not been widely incorporated into health care systems in sub-Saharan Africa. Also, there is a scarcity of studies relating to telepharmacy in sub-Saharan Africa. A review on telepharmacy in the region described the field as novel.¹⁷ In Ghana, the concept of telepharmacy remains unexplored.¹⁸ This study sought to determine the effectiveness of pharmaceutical care interventions implemented through telepharmacy on medication adherence, practice of lifestyle modifications for the control of hypertension and overall blood pressure control among individuals living with hypertension.

2. Method

2.1. Study design and setting

This was a randomized control trial conducted among patients with hypertension recruited from the University Hospital, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi and Ejisu Government Hospital (EGH) from May 2022 to December 2022.

2.2. Sample size

A sample size of 108 was obtained for the study using a web-based sample size calculator for Randomized Control Trials.¹⁹ In estimating the sample size, a hypertension prevalence of 30% was used at a power of 0.8.

2.3. Inclusion and exclusion criteria

Participants were eligible to participate in the study if they were at least 18 years of age, had a medical diagnosis of hypertension, were able to receive telephone calls and provided informed consent. Anyone who could not receive telephone calls for any reason or unwilling to provide informed consent was excluded from the study.

2.4. Recruitment of participants

After voluntarily signing informed consent, study participants were recruited from the study site among patients with hypertension who visited the hypertension clinic for their usual routine care. All patients visiting the hypertension clinic of the hospital were screened for study eligibility. A general announcement about the study was made to all patients who visited these sites. Patients who met the inclusion criteria were then recruited individually. For each hospital, an equal number of participants was assigned to both control and intervention groups. The total number of participants from each hospital, however, depended on the number of patients who visited the clinic during the recruitment period and was hence different at both facilities. The recruitment of participants was done by two research assistants who are both pharmacists and received training prior to the commencement of the study. A two-block randomization approach was used to assign consenting participants randomly to the intervention or control groups. Patients with well controlled blood pressures (<140/90 mmHg) made up one block while those whose blood pressure was not well controlled ($\geq 140/90$) formed the other. This was aimed at allowing equal numbers of both categories of patients in both control and intervention groups.

2.5. Intervention group

All patients assigned to the intervention group had a structured intervention. This consisted of telephone follow-ups in addition to the standard clinical care of visiting the physician at scheduled times for review. Monthly pharmacist-initiated telephone calls were scheduled. The patient follow-up mainly included the provision of pharmaceutical care, answers to specific patient needs and encouragement of their own coping mechanisms in terms of lifestyle adjustments and risk factor reduction. The services offered included adherence counselling, patient education, identification of care issues, blood pressure monitoring, initiating and promoting the practice of therapeutic lifestyles for the control of hypertension. Individualized care with information based on needs, readiness, and drive to learn were prioritized. A pharmaceutical care plan was drawn for each patient. Where physicians needed to make changes to drug therapy, the recommended changes were communicated to the physician by the pharmacist. Pharmacists assessed patients' medications and lifestyle practices and took notes of any issues. To resolve the identified issues and prevent others, Pharmaceutical Care Network Europe (PCNE) V9.1²⁰ was used to classify issues relating to pharmaceutical care while the Subjective, Objective, Assessment, Plan and Objective (SOAPO) approach²¹ was also used in formulating their care plans. Home blood pressure monitoring was encouraged among participants for better monitoring. In cases where patients could not afford personal blood pressure monitors, nearby community pharmacies were recommended for monitoring. Pharmacists ensured that only validated blood pressure monitors were used. During the follow-up, besides general counselling, issues specific to individual patients with hypertension were also discussed. The goal was to normalize common issues or inquiries and make it easier for patients to ask questions. The discussion covered subjects such as lifestyle changes, at-home blood pressure monitoring, and medications reconciliation. Interventions used were adopted from the American College of Clinical Pharmacists' (ACCP) pharmaceutical care model²¹ and a telephone follow-up intervention study for patients discharged with acute myocardial infarction.²² A dedicated phone line was set up for this purpose. Participants received scheduled phone calls at least once monthly and were also allowed to call in at any time for clarifications or advice. Solutions were provided for all pharmaceutical care issues identified. Reiterating information on how the patient himself/herself can lower the risk of cardiovascular complications, identifying issues, clarifying them, setting reasonable goals, calling the pharmacist for clarification and promoting visits to the doctor, if necessary, were some of the strategies used to respond to individual patient concerns.

2.6. Control group

Participants assigned to the control group had routine clinical care, which included a single visit to the hypertension clinic either monthly or bimonthly based on the level of blood pressure control or as determined on by the attending physician. Tele-pharmacy services were not offered to patients in this group.

2.7. Data collection

During hospital visits, clinical data were gathered through self-reporting and from medical records. Baseline data was collected on the day of recruitment. Monthly telephone follow-ups were conducted by a pharmacist for participants in the intervention group. Patients were called at least once every month for the study period. All interactions were documented into a notebook and electronically onto a computer. Blood pressure reading and any identified pharmaceutical care issues were recorded monthly. Endpoints were also assessed by self-report and medical records from the hospital 6 months after follow up. An average call lasted for 10 min. Patients were counselled and any pharmaceutical care issues identified or concerns discussed. Investigations focused on six lifestyle modifications exercise, diet management, cessation of smoking, salt consumption, weight reduction and alcohol intake. With respect to exercise, we asked, 'How often on average do you exercise per week?'. Participants were also asked to rate their salt intake on a scale of 1 to 10 with 10 being the highest preference. Participants who scored five or more on the salt preference scale were categorized as high intake, while those who scored four or less were categorized as low intake. Males and females who took not >2 drinks and 1 drink of alcohol (1 drink = ½ oz. or 15mls ethanol) respectively in a day were categorized as "No" drinkers while those who took more than this were categorized as "Yes" drinkers as per the Dietary Guidelines for Americans.²³ For smoking, we sought to find out if participants were 'still smoking', 'have stopped smoking' or 'never smoked'. Those who were still smoking were classified as smokers (Yes) while those who had stopped smoking or never smoked were classified as non-smokers (No). In total, these six lifestyle practices were considered, physical exercise, consumption of salt, weight reduction, smoking, intake of alcohol and diet management. An awareness score of one was awarded for each of the six lifestyle practices assessed such that one who was aware of all the lifestyle practices would score six out of six. Awareness data was collected through the administration of questionnaires.

The Medication Adherence Rating Scale 10 (MARS-10),^{24,25} a self-reporting scale was used to measure patients' adherence to their anti-hypertensive medications. The scale was grouped into two categories, patients who obtained a score of 6–10 were adherent, 0–5 non-adherent.

2.8. Data analysis

The data collected was entered into SPSS Version 26 for analysis. Frequency tables were used to analyze demographics, risk factors and adherence scores. Patients' awareness of lifestyle modifications used to control hypertension and whether they practiced them was analyzed using the McNemar's test.²⁶ The paired sample *t*-test was used to compare the mean adherence scores, salt consumption rates, systolic and diastolic blood pressures. *t*-test was used to compare difference between the means of endpoints within groups. Percentages were used to compare other lifestyle modifications and blood pressure control at baseline and end of study. The Mann Whitney *U* test and Wilks' Lambda test were used to determine any differences in the outcomes between the control and intervention groups.²⁷ Wilks' Lambda test was used to compare the mean systolic, diastolic blood pressure and medication adherence between groups while Mann Whitney *U* was used to compare the lifestyle modifications. Statistical significance was defined at *p*-value <0.05 with 95% confidence interval.

2.9. Ethical consideration

The study obtained ethical approval from the KNUST Committee on Human Research Publications and Ethics (CHRPE/AP/230/22). The management of both hospitals also gave approval for the conduct of this study. All participants provided informed consent prior to their participation.

3. Results

3.1. Demographic and clinical characteristics of participants at baseline

One hundred and eighteen (118) patients with hypertension were involved in the study. Seventy-eight (78) of the patients were from the Ejisu Government Hospital and 40 from the University Hospital, KNUST. The mean ages of the control and intervention groups were 62.2 ± 10.9 and 62.8 ± 10.5 respectively. The mean systolic and diastolic blood pressures at baseline were 146.2 ± 23.5 and 80.7 ± 11.1 for the control group while the intervention group recorded 148.1 ± 23.6 and 85.8 ± 9.9 respectively. The commonest reason for previous hospital admissions was hypertensive crisis. (Table 1). At baseline there was no statistically significant demographic difference between the groups (Test for homogeneity $p > 0.05$).

3.2. Awareness and practice of lifestyle modifications

A mean awareness score of 3.8 ± 1.7 and 4.1 ± 1.7 were recorded for control and intervention groups respectively. Although awareness was high for the six lifestyle modifications assessed, awareness level did not correspond with practice. Reduction of salt intake was the most known and practiced lifestyle in both groups. However, all the other lifestyle modifications were only patronized by a select few. The association between awareness and practice was statistically significant for all six lifestyle modifications assessed. Tables 2 and 3 summarize the awareness and practice of lifestyle modification among participants in both groups.

3.3. End of study outcomes

3.3.1. Blood pressure control

At baseline, the mean systolic pressures for both control and intervention groups were above the recommended range. At the end of the study, there was an increase in the number of participants with the blood pressures adequately controlled for both groups, however the intervention group saw a greater increase (Table 4).

The difference in mean systolic and diastolic blood pressure readings at baseline and at the end of the study was statistically significant for the intervention group. Differences in mean for the control groups were however not significant (Table 5). Between the groups, there was a statistically significant reduction in the systolic blood pressure but not the diastolic blood pressure.

3.3.2. Medication adherence

After 6 months, the proportion of adherent participants increased from 85.7% to 96.5% in the intervention group (Mean_{baseline} = 7.1 ± 1.4 , Mean_{6months} = 8.4 ± 0.9). There was a statistical significance between the mean adherence score at baseline and after 6 months (Mean = -1.33 , SD = 1.21, CI = $-1.65 - -1.01$, $p = 0.000$). The control group also recorded an improvement in the adherence level Mean_{baseline} = 7.6, Mean_{6months} 7.9) although the difference was of no statistical significance ($p = 0.085$). Between the control and intervention groups, the level of adherence was not statistically significant ($p = 0.242$).

3.3.3. Pharmaceutical care issues

Fifteen pharmaceutical care issues were identified throughout the study period among intervention groups. The care issues were classified

Table 1
Demographic characteristics of participants

Variable	Frequency (%)	
	Control (n = 59)	Intervention (n = 59)
Age		
30–39	2 (3.4)	2 (3.4)
40–49	5 (8.5)	2 (3.4)
50–59	12 (20.3)	18 (30.5)
60–69	27 (45.8)	23 (39.0)
70–79	10 (16.9)	11 (18.6)
80–89	3 (5.1)	3 (5.1)
Sex		
Male	9 (15.3)	15 (25.4)
Female	50 (84.7)	44 (74.6)
Educational level		
No Formal Education	13 (22.0)	9 (15.3)
Basic School	6 (10.2)	4 (6.8)
Junior High School	25 (42.4)	19 (32.2)
Senior High School	13 (22.0)	14 (23.7)
Tertiary	2 (3.4)	13 (22.0)
Occupation		
Farmer	9 (15.3)	10 (16.9)
Retired	28 (47.5)	30 (50.8)
Trader	18 (30.5)	12 (20.3)
Caterer	0 (0.0)	1 (1.7)
Jobless	2 (3.4)	3 (5.1)
Plumber	0 (0.0)	1 (1.7)
Immigration Officer	0 (0.0)	1 (1.7)
Teacher	0 (0.0)	1 (1.7)
Cleaner	2 (3.4)	0 (0.0)
Insurance status		
Private Insurance	1 (1.7)	1 (1.7)
National Health Insurance	58 (98.3)	58 (98.3)
BMI category		
Underweight (<18.5 kg/m ²)	2 (3.4)	4 (6.8)
Normal (18.5 - <25 kg/m ²)	28 (47.5)	24 (40.7)
Overweight (25 - <30 kg/m ²)	17 (28.8)	23 (39.0)
Obese (>30 kg/m ²)	12 (20.3)	8 (13.6)
Family history of hypertension		
Yes	41 (69.5)	38 (64.4)
No	7 (11.9)	7 (11.9)
Don't know	11 (18.6)	14 (23.7)
Diabetes comorbidity	30 (50.8)	30 (50.8)
Blood pressure control		
Controlled	23 (39.0)	23 (39.0)
Not controlled	36 (61.0)	36 (61.0)
Self-monitors blood pressure	9 (15.3)	15 (25.4)
Number of prescribed antihypertensives		
1	14 (23.7)	18 (30.5)
2	28 (47.5)	26 (44.1)
3	15 (25.4)	13 (22.0)
4	2 (3.4)	2 (3.4)
Previous admissions	17 (28.8)	20 (33.9)
Reason for Previous admission		
Diabetes	2 (3.4)	3 (5.1)
Hypertensive crisis	12 (20.3)	16 (27.1)
Stroke	2 (3.4)	1 (1.7)
Deep Vein Thrombosis	1 (1.7)	0 (0.0)
Adherence		
Non adherent (0–5)	13 (22.0)	17 (28.8)
Adherent (6–10)	46 (78.0)	42 (71.2)

in accordance with the Pharmaceutical Care Network Europe V9.1 model.²⁰ The majority of care issues identified centered on treatment safety. Eighty percent (80%) of all pharmaceutical care issues identified did not require direct referral to a physician. The general practitioners agreed and accepted all care issues referred to them. Eighty-seven percent (87%) of identified care issues were resolved by the 6th month of follow-up (Table 6). Conversely, the control group only saw a resolution of three out of fourteen (21.4%) identified pharmaceutical care issues at the end of the study.

3.3.4. Lifestyle Practices

There was a reduction in the consumption of salt among the

Table 2
Awareness and practice of lifestyle modifications, control.

Aware of lifestyle modifications	Practices lifestyle		McNemar test – p-value
	Yes	No	
Exercise			0.000
Yes	39.0	42.4	
No	3.4	13.6	
Alcohol Intake			0.000
Yes	8.5	32.2	
No	0.0	59.3	
Smoking			
Yes	0.0	32.2	
No	0.0	67.8	
Weight Reduction			0.000
Yes	22.0	37.3	
No	0.0	40.7	
Reduction of Salt Intake			0.000
Yes	74.6	20.3	
No	0.0	5.1	
Diet management			0.004
Yes	42.4	27.1	
No	5.1	25.4	

Table 3
Awareness and practice of lifestyle modifications, intervention.

Aware of lifestyle modifications	Practices lifestyle		McNemar test – p-value
	Yes	No	
Exercise			0.000
Yes	44.1	39.0	
No	1.7	15.3	
Alcohol Intake			0.000
Yes	15.3	30.5	
No	0.0	54.2	
Smoking			0.000
Yes	3.4	35.6	
No	0.0	61.0	
Weight Reduction			0.000
Yes	20.3	40.7	
No	0.0	39.0	
Reduction of Salt Intake			0.002
Yes	79.7	16.9	
No	0.0	3.4	
Diet management			0.000
Yes	52.5	35.6	
No	3.4	8.5	

Table 4
End of study blood pressure readings.

Variable	Frequency (%)				Wilk's Lambda test - p-value
	Control (n = 59)		Intervention (n = 57)		
	Baseline	End of study (6 months)	Baseline	End of study (6 months)	
Mean systolic	146.2 ± 23.5	145.9 ± 23.3	148.1 ± 23.6	134.8 ± 13.7	0.001
Mean Diastolic	80.7 ± 11.4	80.2 ± 11.1	85.8 ± 9.8	79.5 ± 8.7	0.198
Controlled BP	39.0%	40.7%	39.0%	66.1%	

intervention group leading to a decrease in the mean salt intake values at the end of the study. The proportion of people with low salt intake increased from 57.9% to 89.5%. The difference between means were statistically significant (Mean_{baseline} = 3.9 ± 1.8, Mean_{6months} = 3.2 ± 1.3, p = 0.00). On the other hand, only a 3.4% increase in the number of individuals with low salt consumption was observed.

The number of individuals who exercised in a week saw an increase

Table 5
Difference between mean blood pressure readings within groups.

Group	Paired difference					t	df	Sig (2-tailed)
	Mean	Standard Deviation	Standard error of mean	95% Confidence interval of difference				
				Lower	Upper			
Control								
Systolic BP	0.2	17.2	2.2	-4.2	4.7	0.1	58	0.916
Diastolic BP	0.5	11.5	1.5	-2.5	3.5	0.3	58	0.743
Intervention								
Systolic BP	13.3	15.3	2.0	9.2	17.4	6.5	56	0.000
Diastolic BP	6.2	10.0	1.3	3.5	8.8	4.7	56	0.000

Table 6
Pharmaceutical care issues identified.

Primary domain	Sub-classes	Frequency (%)	Intervention offered
Treatment effectiveness	1. Uncontrolled Blood Pressure ($\geq 140/90$ mmHg)	36 (61.0)	Adherence counselling, Medicine reconciliation
Treatment Safety	2. Decreased libido	1 (1.7)	Counselling on sexual health, ie. Appropriate use of sexual enhancers when necessary.
	3. Palpitations	2 (3.4)	Brand of medication changed (Atenolol)
	4. Numbness in the feet/hands	5 (8.5)	Medicine supplementation (Vitamins)
	5. Persistent dry cough	5 (8.5)	Medication (Angiotensin Converting Enzyme Inhibitors) changed
	6. Frequent urination which disturbs sleep	9 (15.3)	Counselled to take diuretic medication in the morning
	7. Heart burn	1 (1.7)	Counselled on weight loss using diet and lifestyle
	8. Sleeplessness	4 (6.8)	Counselled to take medicine in the morning
	9. Headache	5 (8.5)	Counselling on adherence and medication side effects
	10. Dizziness	3 (5.1)	Counselled to take medicine in a sitting position
	11. Pedal oedema	5 (8.5)	Medication changed
	12. Swollen lips	1 (1.7)	Medication changed
	13. Fatigue	1 (1.7)	Counselling on side effects of medications
Others	14. Use of unprescribed herbal products for hypertension	4 (6.8)	Discontinue unprescribed products
	15. Non-adherence	17 (78.8)	Adherence counselling

through the study period. At the end of the study, 77.2% of participants engaged in at least 30 min exercise once in a week from the initial 47.4%. Fried food and alcohol intake saw a marginal decline, only one more individual stopped taking alcohol at the end of the study. All

participants stayed away from smoking (Table 7).

Table 7
Lifestyle practices.

Variable	Frequency (%)				Mann Whitney U Test – p-value
	Intervention (n = 57)		Control (n = 59)		
	Baseline	End of study	Baseline	End of Study	
Salt consumption					0.014
Low Intake	33 (57.9)	51 (89.5)	40 (67.8)	42 (71.2)	
High Intake	24 (42.1)	6 (10.5)	19 (32.2)	17 (28.8)	
Exercise					0.012
None	30 (52.6)	13 (22.8)	34 (57.6)	32 (54.2)	
Once a week	7 (12.3)	18 (31.6)	3 (5.1)	8 (13.6)	
Two times a week	7 (12.3)	13 (22.8)	8 (13.6)	10 (16.9)	
Three times a week	4 (7.0)	4 (7.0)	8 (13.6)	6 (10.2)	
Four times a week	9 (15.8)	9 (15.8)	6 (10.2)	3 (5.1)	
Smokes					1.000
Never smoked	55 (96.5)	55 (96.6)	57 (96.6)	57 (96.6)	
Stopped smoking	2 (3.5)	2 (3.5)	2 (3.4)	2 (3.4)	
Alcohol intake					0.169
Yes	10 (17.5)	9 (15.8)	5 (8.5)	5 (8.5)	
No	47 (82.5)	48 (84.2)	54 (91.5)	54 (91.5)	
Intake of fried foods					0.072
Never	2 (3.5)	3 (5.3)	3 (5.1)	3 (5.1)	
Rarely	29 (50.9)	35 (61.4)	26 (44.1)	26 (44.1)	
Sometimes	23 (40.4)	17 (29.8)	25 (42.4)	29 (49.2)	
Often	1 (1.8)	2 (3.5)	5 (8.5)	1 (1.7)	
Always	2 (3.5)	0 (0.0)	0 (0.0)	0 (0.0)	

4. Discussion

Controlling high blood pressure remains a major challenge even among individuals with a confirmed diagnosis of hypertension. It is a critical area of medical and research concern due to its far-reaching consequences. This study sheds light on innovative approaches utilized by pharmacists and findings that can aid in improving the control of blood pressure and reduce the risk of associated health complications.

Participants in this study had varying levels of formal education; a few others (18.6%), however, had no form of formal education. Most of the participants in this study were females, in contrast with an earlier study conducted.²⁸ This observation could be as a result of higher health seeking behavior of females over their male counterparts.²⁹ The previous study was conducted at the workplace where participants did not have to visit a hospital.²⁸ It is not surprising that a few participants were in their thirties and forties considering recent trends of increasing hypertension prevalence in young adults.^{30,31} Being overweight or obese has been shown to increase the risk of hypertension and promote early onset of hypertension.³² The mean age of 62 however was consistent with the higher prevalence of hypertension in adults.⁵³³ Most participants were retired workers and depended solely on health insurance for healthcare. In line with evidence from existing data, most participants had a known family history of hypertension and comorbid diabetes.³⁴ The majority of patients were managed on dual therapy and had no hospital admissions in the last six months. The commonest cause of hospital admissions among those with previous admission however was hypertensive crisis. Similar to the results on a study on hypertensive crisis, this suggests sub-optimal management among them.³⁵

High salt intake among patients with hypertension has been a subject of great concern for healthcare providers. Several interventions aimed at promoting the reduction of salt consumption such as that employed in this study have been exploited in different settings. Although initial salt consumption of participants was low, there was a further reduction after follow-up. Although both control and intervention groups recorded an increase in the number of individuals adopting reduced salt consumption, the increase was significant in the intervention group primarily due to the implemented interventions, distinguishing it from the control group. One of the major priorities for the World Health Organization (WHO) in addressing the worldwide non-communicable disease crisis is the reduction of dietary salt consumption. In order to reduce the number of deaths from hypertension, cardiovascular disease, and stroke, it has urged member countries to adopt steps to reduce dietary salt consumption.³⁶ In hypertensive individuals, reduction of dietary salt intake can facilitate and may represent a simple cost-saving mediator to reduce cardiovascular morbidity and mortality.^{37,38} However, a greater decrease in blood pressure is achieved when reduced salt intake is combined with other lifestyle modifications, such as physical activity, reduced intake of alcohol, fried food and smoking.³⁹ Smoking and alcohol consumption were not a common practice. This may be largely attributed to the fact that, in Ghana, most cultures despise smoking, which is considered culturally abnormal.^{40,41}

Awareness of lifestyle modifications necessary for the control of hypertension was high among the participants. This may be due to increased hypertension awareness and education programs over the years. However, similar to earlier studies, the high level of awareness did not match its practice.^{28, 42,43} Another Ghanaian study revealed that, despite being aware of the many advantages connected with lifestyle modification, most still find it challenging. The same study identified patient's reluctance to adhere to lifestyle modification as the biggest hurdle to non-pharmacologic management of hypertension.⁴³ Utilization of effective follow-ups and reminders, as in this study, can increase adherence to lifestyle modifications for the management of hypertension. Efforts to promote the practice of these lifestyle modifications and not mere awareness yielded positive results in this study. There was a decrease in the number of people who did not engage in any form of exercise, no new smokers were recorded, the number of frequent alcohol

consumers and fried food consumption reduced. Over half of individuals who did not engage in any form of exercise, initiated exercise participation in response to telepharmacy intervention. To effectively manage hypertension using lifestyle modifications, a multifaceted strategy is necessary. This should not only be started in beginning of therapy but also continued along with medicines to have maximum effects.^{39,44} This multifaceted approach was facilitated with the implementation of telepharmacy in this study. Telepharmacy provides a convenient avenue for both patients and pharmacists.

Adherence to therapy is a key determinant of clinical outcomes. The number of medicines prescribed for a patient, knowledge on the medications and medicine-related care issues such as adverse reactions and side effects have been shown to be good predictors of medication adherence.^{45,46} All participants in this study were prescribed less than five medications for their condition, thus eliminating polypharmacy. The elimination of polypharmacy by the prescribers may contribute to the high level of adherence recorded at baseline. High pill burden among individuals with hypertension has been identified in several research as a key worry.^{47,48} Over the six months period, a number of pharmaceutical care issues were identified among participants. Pharmacists involved in the study successfully resolved most of the care issues, improving medication adherence and clinical outcomes. The study revealed that for most drug-related issues encountered by individuals with hypertension, there was no pressing need for a referral to a physician. At the end of the study, there was an increase in the number of adherent patients and a statistically significant increase in the mean adherence score.

Control of blood pressure improved over the study period. This is evident from the decrease in mean systolic and diastolic readings. Although the decrease was observed in both control and intervention groups, it was statistically significant for the intervention group only. The provision of telepharmacy services to the intervention group played a valuable role in achieving this. These outcomes are in line with studies from the United States where telepharmacy is well developed.¹⁵ For individuals with hypertension, a decrease in blood pressure readings translates into positive clinical outcomes. Lowering blood pressure has been proven to significantly reduce the risk of coronary heart disease, stroke and heart failure.^{49,50}

In improving blood pressure control, pharmacists were able to promote the practice of therapeutic lifestyle modifications, improve medication adherence and identify medicine-related issues through telepharmacy. With such outcomes, the provision of telepharmacy services provides a great advantage not just for patients, pharmacists and physicians but the health care system as a whole. Patients can be assured of around-the-clock pharmaceutical care and require less in-person follow-ups. This is particularly important in settings such as ours where post diagnosis counselling is uncommon.⁵¹ Health care personnel, on the other hand, can rely on tele-pharmacists for effective drug monitoring and therapy recommendations where necessary. Similar to the UK and America where millions of dollars are lost to medication annually,^{52,53} in sub-Saharan Africa, financial losses due to medication errors is enormous.⁵⁴ Telepharmacy services can aid the prevention of such losses and lessen the burden on health care systems.

5. Limitations

In this study participants were recruited from only two hospitals in Ghana. The limited geographical focus may restrict generalizability of the findings to a broader population, especially given regional differences in healthcare access and patient demographics. Medication adherence and lifestyle modifications were assessed using self-reported scales, which can be subject to recall bias and over reporting of positive behaviors as opposed to the use of objective measures such as pill count or electronic monitoring.

6. Conclusion

Pharmacists play an integral role in the control of blood pressure among individuals with hypertension. Telepharmacy is effective in promoting the practice of therapeutic lifestyle modifications, promoting medication adherence and identifying pharmaceutical care issues among patients with hypertension. Blood pressure control is optimized when telepharmacy is utilized by pharmacists. Telepharmacy, apart from providing patients with pharmaceutical care at their convenience, also reduces burden on the healthcare system while improving clinical outcomes. This work provides information on interventions that could enhance the quality of life and wellbeing of people living with hypertension. Adopting telepharmacy, especially in sub-Saharan Africa where access to healthcare is hindered by numerous challenges, can contribute immensely to promoting good health and well-being for all particularly for people with chronic diseases such as hypertension.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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