

# The effectiveness of medication therapy management services in the care of hypertensive patients in a developing setting

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**ABSTRACT:** Chronic diseases such as hypertension and diabetes have become a significant public health problem yet most patients on medications have their blood pressure uncontrolled. There is the need for feasible and affordable health improvement methods for primary prevention and effective management. Medication Therapy Management seeks to optimize medicine use, identify and resolve medication related issues and improves clinical outcomes. This study sought to assess the role of medication therapy management in the resolution of medication related problems and blood pressure control among patients with hypertension. This was a quasi-experimental study carried out in the hypertension clinic of Wenchi Methodist Hospital, Ghana. A total of 94 hypertensive patients were followed for seven months. Clinical outcomes measured were blood pressure and the number of drug related problems. One hundred and thirty medication related issues were identified throughout out the study period. The commonest medication related issues were associated with drug use problems (37, 28.5%). Prescribers and patients accepted 115 (88.5%) and 114 (87.7%) interventions respectively. Reductions in the mean systolic blood pressure, the number of medication related issues with respect to drug choice, drug use and dosing at the end of the study in the study group were significant. The Medication Therapy Management services offered by the pharmacist improved blood pressure control, identification, and resolution of medication related issues. These services could be adopted as part of routine services in the management of patients with chronic diseases in hospitals in developing countries.

**KEYWORDS:** Medication Therapy Management; Hypertension; Pharmacist; Pharmaceutical Care; Chronic diseases, Medication Related Issues

## 1. INTRODUCTION

One billion people are estimated worldwide to have hypertension. (Hypertension, 2019) Two-thirds of this number are found in low and middle-income countries such as Ghana. (Hypertension, 2019) In Ghana, an estimated 2.8 million people have hypertension, out of which about half a million have their blood pressure controlled effectively with antihypertensives. (Gad et al., 2019) Chronic diseases such as hypertension and diabetes have become a significant public health problem in Ghana. Hypertension prevalence in Ghana is estimated at 27% to 30 %. (Atibila et al., 2021; Bosu & Bosu, 2021) This number five reason for Out Patient Department (OPD) attendance in most regions in Ghana is hypertension. (Bosu & Bosu, 2021) Hypertension may often present with co-morbid conditions like diabetes resulting in increasing risk of hypertension complications. (Hypertension, 2019) The Ghana demographic health survey indicated that a quarter of those aged 35 to 49 suffered from hypertension. (Nyarko et al., 2017) Furthermore 80% of men and 60% of women and diagnosed with hypertension were not aware of their condition. However, among hypertensive patients, although most of them are on medications about half have uncontrolled blood pressure. Thus, there is the need for feasible and affordable health improvement methods for primary prevention, case finding and effective treatment for hypertension.

Medication therapy management, also referred to as MTM, is a term used to describe a broad range of health care services provided by pharmacists, the medication experts on the health care team. MTM service

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model in pharmacy practice includes the five core elements: Medication therapy review (MTR), Personal medication record (PMR), Medication-related action plan (MAP), Intervention and/or referral, Documentation and follow-up. These core elements each play an integral part in the provision of MTM. However, to accommodate the demands of each patient, the order and delivery of the essential components may be changed. By actively managing drug therapy and recognizing, avoiding, and resolving medication-related issues, pharmacists help patients get the most benefits out of their medications. (Medication Therapy Management (MTM) | APhA Foundation). Research conducted in the developed countries examining MTM service indicated that it is effective in ensuring the most rational use of medications and a cost-effective strategy for increasing patients' knowledge on medications as well as lowering blood pressure and blood sugar levels. (De Oliveira et al., 2020; Planas et al., 2009; Tilton et al., 2019; Wittayanukorn et al., 2013) Due to the immense benefits of MTM services in the developed setting there is the need to explore the benefits of such a service in improving patient outcomes in a developing country. The objective of this study was to assess the role of medication therapy management in the resolution of medication related issues and blood pressure control among patients with hypertension

## 2. RESULTS

### 2.1 Demographic and Clinical Characteristics of Participants

Forty-six and 48 respondents in the intervention and control group respectively completed the study. Four patients in the intervention group and 2 in the control group were lost to follow up. There were 14 (30.4%) patients with diabetes in the study group and 16 (33.3%) in the control group. The minimum and maximum ages within the study group were 35 years and 81 years respectively with a mean age of 60.8 years (SD=±9.9) A high proportion of respondents in both the intervention and control group had basic education as their highest level of education. About 40% of respondents in both the intervention and control group had BP less than 140/90 mmHg. The mean time taken to offer the intervention was 15 minutes. There were no differences in the demographic and clinical characteristics between the study and control groups. (Table 1).

**Table 1: Demographic Characteristics of Participants**

Variable	Study group n (%) n=46	Control group n (%) n=48	P Value
<b>Sex</b>			
Male	18 (39.1)	16 (33.3)	0.300
Female	28 (60.9)	32 (66.7)	
<b>Age (Years)</b>			
18-40	1 (2.0)	3 (6.0)	0.650
41-60	21 (46.0)	20 (42.0)	
> 60	24 (50.0)	25 (52.0)	
Minimum age	35	33	
Maximum age	81	92	
Mean age (years)	60.8	60.5	
Standard Deviation	±9.9 years	±10.7	
<b>Educational Background</b>			
Basic Education	26(56.5)	28 (68.3)	0.134
Secondary education	15 (2.6)	18 (37.5)	
Tertiary	5 (10.9)	2 (4.2%)	
<b>Health Insurance</b>			
National Health insurance	42 (91.3)	43(89.6)	0.071
Cash and carry	4(8.7)	5 (10.4)	
<b>BP (mmHg)</b>			
Normal (<120/80)	7 (15.2)	8 (16.7)	0.670
Pre- HPT (120-139/81-89)	22 (47.8)	20 (41.7)	
HPT Stage-1 (140-159/90-99)	14 (30.4)	15 (31.2)	
HPT Stage-2 (≥160/>100)	3 (6.5)	5 (10.4)	
<b>Co-morbidity</b>			
Diabetes	14 (30.4)	16 (33.3)	0.155

p<0.05 is statistically significant

## 2.2 Medication Related Issues Identified Among Patients in the Intervention Group

Six classes of Medication Related Issues issues were identified per the PCNE V5.01 categorization. (Pharmaceutical Care Network Europe, 2003). One hundred and thirty medication related issues were identified throughout out the study period among intervention group. The commonest medication related issues were associated with drug use problems (37, 28.5%) (Table 2) Out of the 130 interventions, 115 (88.5%) were accepted by the prescribers and 114 (87.7%) accepted by patients.

**Table 2: Medication Related Issues Identified and Solutions provided among hypertensive patients in the intervention group.**

Drug Related Problem (DRPs)	Interventions
<b>1. Adverse Drug Reactions (n=7, 5.4%)</b>	
Dry cough Angioedema Difficulty in breathing associated with Lisinopril	Lisinopril 10mg changed to amlodipine 10mg
Pedal oedema associated with amlodipine	Amlodipine 10mg changed to Lisinopril 10mg
<b>2. Drug Choice Problem (n=20, 15.4%)</b>	
FBS > 7mm/dl but no drug was prescribed.	Lifestyle modification and followed up for further FBS Tests.
Table 2 continued	
Prophylaxis against CVAs with Aspirin 75mg and statins required but not prescribed	Consulted with the physician for the initiation of these therapies.
Concomitant administration of metformin gliclazide resulting in hypoglycemia	+ Consulted with the physician to correct the duplication of gliclazide
Concomitant administration of Lisinopril/hydrochlorothiazide 10/12.5mg Lisinopril 10mg resulting in hypotension	+ of Consulted with the physician to correct the duplication of lisinopril.
No indication for prolong use of NSAIDs	Consulted with the physician to cease the use of NDAIDS.
<b>3. Drug Interactions (n=4, 3.1%)</b>	
Concomitant administration of Atenolol 50mg, Lisinopril 10mg and doxazosin 4mg daily resulting in hypotension	Dose of lisinopril reduced Education on the appropriate time to take these medication to reduce the risk of hypotension.
Concomitant administration of tamsulosin and erythromycin, erythromycin inhibits metabolism of tamsulosin resulting in hypotension and dizziness on bending to sit or standing up	Erythromycin changed to amoxicillin and patient educated and counselled to take tamsulosin at bedtime
<b>4. Dosing Problems (n=29, 22.3%)</b>	
Inappropriate timing of administration and inappropriate dosing intervals	Education and counselling offered on the appropriate time to take medication.
Patients forgets/skips medications	Counselled to take medications same time each day, take missed doses as soon as they remember, skip missed doses if close to next scheduled dose and medications should be carried along any travels.
Misinterpretation of dosage instructions	Pictograms used to make dosing instructions

clearer

### 5. Drug Use Problems (n=37, 28.5%)

Patients did not understand reasons for drug therapy	Educated on disease state and medications was done with pictorial images.
Patients was afraid that drugs will affect their libido	Educated on the purpose of their medication and encouraged then to inform the physician or pharmacist if they experience any unwanted effects.
Unavailability of prescribed drugs at the hospital	Recommended a pharmacy close to them
Concerned about pill burden	Dosage regimens simplified and combination therapies given when necessary.

### 6. Miscellaneous (n=33, 25.4%)

Additional BP and RBS monitoring needed	Patients asked to visit the nearest community pharmacy for BP and RBS measurement. Patients with BP and Glucometers at home were asked to monitor their BP and RBS and record it.
Patients needed additional FBS diagnostic testing	Patients FBS were tested every month during their MMT service follow-up to confirm the presence or absence of diabetes Those diagnosed with diabetes were referred to the prescriber for consultation and medications as appropriate
Patients not satisfied with medication therapy	Reassurance given to patients and reasons why medicines were given explained.
Inadequate knowledge on their disease state and medications	Educational leaflets used for educating patients on disease and mediation
Concomitant use of herbal medicines with orthodox medicines prescribed	Patients advised not to take these tow medicines together and a herbal medicine practitioner consulted.

## 2.3 End of study outcome measures

The study showed a significant reduction in the mean systolic ( $p=0.002$ ) and diastolic blood ( $p=0.032$ ) pressures in the intervention group at the end of the study. In the control although there were reductions in both the Systolic and Diastolic Blood Pressures (SBP and DBP) they were not statistically significant. (Table 3) There was a significant reduction in the number of medication related issues with respect toto drug choice ( $p= 0.008$ ), drug use ( $p=0.007$ ) and dosing ( $p=0.025$ ) at the end of the study in the intervention group. (Table 4) The mean systolic blood pressure between the study and control groups for the time period was statistically significant ( $F=8.036$ ;  $p=0.006$ ; partial  $\eta^2 =0.080$ ). However

the mean diastolic blood pressure between the study and control groups were not statistically significant ( $F= 0.729$ ;  $p=0.395$ ; partial  $\eta^2 =0.018$ ). Furthermore, there was an association between the intervention offered and attainment of blood pressure control [OR, 1.417; 95% CI, 1.683-3.739,  $p=0.02$ ]. The end of study blood pressure measurements showed that 40 (86.9%) participants in the study group and 34 (70.8%) in the control group had blood pressures less than 140/90 mmHg.

**Table 3: Difference in systolic and diastolic blood pressures at baseline and end of the study.**

Variable	Paired Difference		Standard error of mean	95% interval of difference	Confidence of	T	df	Sig. (2-tailed)
	Mean difference	Standard deviation SD						
<b>Study Group</b>								
Systolic BP	5.5652	11.3464	1.6729	2.196	8.9347	3.327	45	0.002
Diastolic BP	2.2174	4.5603	0.6724	0.8672	3.5716	3.298	45	0.032
<b>Control Group</b>								
Systolic BP	0.8125	12.8687	1.8574	-4.549	2.9242	-0.437	47	0.664
Diastolic BP	1.125	5.6967	0.822	-2.779	0.5291	-1.368	47	0.178

**Table 4: Medication Related Issues at baseline and end of study**

Variable	Study Group		p-value
	Baseline n (%)	End of Study n (%)	
Adverse Drug Reaction	5 (7.8)	1 (5.0)	0.231
Drug Choice Problem	10 (15.6)	2 (10.0)	0.008
Drug Interaction	4 (6.25)	1 (5.0)	0.062
Dosing Problem	15 (23.4)	5 (25.0)	0.025
Drug use Problem	18 (28.1)	8 (40.0)	0.007
Miscellaneous	12 (18.6)	3 (15.0)	0.018
<b>Total</b>	<b>64</b>	<b>20</b>	

### 3. DISCUSSION

A greater portion of our study participants were above 60 years. This is consistent with several studies confirming a greater risk of hypertension as age increase. (Atibila et al., 2021; Bosu & Bosu, 2021; Zhou et al., 2021) Furthermore the setting of the study may have accounted for this as the rural areas in Ghana often has a greater elderly population. The number of females in both the study group and control group were greater than their male counterparts. This may be due established poor health seeking behavior among men as all the respondent were recruited from the hospital. (Hunt et al., 2011; Thompson et al., 2016) The Ghanaian education system is divided in three parts; basic education, secondary education and tertiary education. Basic education is free and compulsory. It is the minimum period of schooling needed to ensure that one acquires basic literacy. In both intervention and control arms of this study, majority of participants had just basic education, this could influence how they seek, understand and accept pharmaceutical services including MTM. In addition, this could have also positively influenced their patronage of the MMT services offered. Only four patients in the study group were lost to follow up. The majority of respondents in both the study and control group had BP less than 140/90mmHg at baseline signifying good blood pressure control. However, at the end of the study more respondents in the study group had better blood pressure



control. This implies that continuous monitoring and follow up could lead to better control of blood pressure.

Medication related issues identified among patients in the intervention group were associated with medicines choices, dosing, uses and interactions with drug use problems being the commonest. (Table 2) There was a significant decrease in the number of medication related issues in the intervention group owing to the interventions provided. The control group however saw the resolution of only 7% of the identified medication related issues at the end of the study as they did not receive any interventions. (Table 4) In studies to explore and classify drug related problems among patients with hypertension the most frequently reported DRPs were; drug interactions, drug choice problems, drug use problems (uncertainty/lack of knowledge about aim of medication) and ADRs (Eichenberger Patrick, 2010; Planas et al., 2009; Yimama et al., 2018) Our study demonstrates that MTM service is an effective tool for the identification and resolution of medication related issues. The existence of several medication related issues at baseline confirms the gap in the medication reconciliation process in our hospitals. This brings to light the need for MTM services by pharmacists as part of routine health care especially for patients with chronic diseases. In this study, majority of pharmacist's recommendations put forward to solve medication related issues were accepted by the prescribers and patients. This is positive and may point to the acceptance of medication use review services by both patients and prescribers in the hospital.

The mean difference in systolic and diastolic BP at baseline and at the end of the study were statistically significant within the study group unlike in the control group (Table 3). These findings are similar to that of studies evaluating the effect of MTM on clinical outcomes which recorded significant improvement in systolic and diastolic BP after receiving MTM services. (Anderson et al., 2021; Negash et al., 2021; Sharrel L. Pinto, Jinender Kumar, Gautam Partha, 2014). Between the groups, the difference in the mean systolic blood pressure was of statistical significance. Another study evaluating the impact of pharmaceutical care programs on medication adherence and blood pressure control reported significant reduction in systolic BP after exposure to MTM services. (Lee et al., n.d.) This underscores the need for the provision of MTM services as this finding clearly points out that the routine hospital scheduled visits alone has low success rate at optimizing blood pressure control.

Hospital pharmacists in developing setting such as Ghana with increasing prevalence of hypertension and low levels of blood pressure control should be involved MTM services to optimize disease control. Hospitals and health insurance companies should engage pharmacists to implement MTM services in the management of patients with chronic diseases. The mean time taken to offer the MTM service was fifteen minutes. Facilities willing to offer this service would have to consider the pharmacist staffing strength and the number of patients with chronic diseases visiting the hospital. Furthermore, these service was offered free of charge as hospital pharmacist working in government facilities cannot charge for any services offered. However, for pharmacists to be motivated to offer these services there may be the need for remuneration. Health insurance companies could pay a token to facilities offering MTM services are cost saving to insurers. (Priya et al., 2021) Regulatory bodies and practice organizations such as the Pharmaceutical Society of Ghana, Government and Hospital Pharmacist Association (GHOSPA) and Pharmacy Council, Ghana should engage pharmacists and health insurance companies in MTM services workshops as this could create awareness of these services.

With the increasing prevalence of hypertension in developing countries such as Ghana, hospital pharmacists need to undertake MTM services for effective control. Facilities must consider engaging more pharmacist in order to effectively provide these services. In this study, the services were offered for free. However, for a successful and sustainable provision of MTM services, the hospital and/or health insurance companies may consider remunerating pharmacists who provide these services. Health insurance companies could pay a token to facilities offering MTM services are cost saving to insurers. (Priya et al., 2021) Regulatory bodies and practice organizations such as the Pharmaceutical Society of Ghana, Government and Hospital Pharmacist Association (GHOSPA) and Pharmacy Council, Ghana could engage pharmacist and health insurance companies in MTM services workshops to enlighten them on the services. The mean time taken to offer the MTM service was fifteen minutes per patient.

### 3.1 Implications on Practice

Blood pressure control is a major concern among most hypertensive patients and in a developing setting where the public health care settings are overburden. The hospital pharmacist is well positioned to offer pharmaceutical care services to improve the care of such patients. MTM services should be seen as part of the services hospital pharmacists can offer especially in poorly resourced setting where there is increase

prevalence of hypertension. This could also create job opportunities for hospital pharmacists since more pharmacists will be needed to offer these services. However, there is the need for specific guidelines and policies on how these services should be implemented and well patronized as currently there are no guidelines.

### 3.2 Limitation of the study

The main limitation of the study was using a nonrandomized study design instead of a randomized controlled trial which is the gold standard. The study was conducted in only one of the sixteen regions in Ghana. Generalizability of the study may be limited due to the small sample size used.

## 4. CONCLUSION

The Medication Therapy Management service offered by the pharmacist resulted in a statistically improvement blood pressure control, identification and resolution of medication related issues. MTM services could therefore be adopted as part of routine services in the management of patients with chronic diseases such as hypertension and in hospitals in developing countries. Policies should be enacted to encourage collaborations between health insurance companies and healthcare facilities for the provision of MTMs to improve the pharmaceutical care of patients with chronic diseases.

## 5. MATERIALS AND METHODS

### 5.1 Study Site and Design

A prospective quasi experimental design was carried out at the hypertension clinic of the Methodist Hospital in Wenchi in the Brong Region of Ghana. Wenchi is a peri-urban area surrounded predominantly by rural farming communities. The facility is a 240-bed capacity primary healthcare facility that serves as the Municipal hospital in the Wenchi municipality, a major referral center for clinics, health centers and hospitals of the Tain and Banda Districts which are rural settings and part of the Kintampo and Bole Bamboi Districts which are peri-urban settings. Furthermore, for the past two years hypertension was among the top ten causes of outpatient attendance and in-patient's admissions.

### 5.2 Inclusion and Exclusion Criteria

Patients aged 18 years and above who had previously been diagnosed with hypertension and had prescription refill records for at least one year were included in this study. Diabetes was the only co-morbid condition considered. Newly diagnosed patients and those who had less than one year of prescription records were excluded from the study. Patients who were unwilling to come for follow up meetings and without contact numbers were excluded from the study.

### 5.3 Sampling and Sample size.

A sample size of 100 hypertensive patients was obtained for the study from a formula for calculating sample size for interventional studies. (Charan & Biswas, 2013) These hypertensive patients were recruited by purposive sampling based on our inclusion criteria over a week. These 100 patients were divided into two groups, 50 in the intervention and 50 in the control group. Excel was used to assign patients into two groups. In dividing these patients into two groups the blood pressure categories and comorbid conditions were considered to ensure that there was equal representation of these variables in each group.

### 5.4 Description of the Medication therapy management offered service

The medication therapy management service offered was based on a model proposed by the American Pharmacist Association (APA). (Lemay, 2012) Services offered included personal medication record, comprehensive medication therapy review, medication related action plan, intervention and referral documentation and follow up. For medication review, patients' drugs medications including prescription, non-prescription and herbal remedies were reviewed. The indications, doses, and directions for use of these medicines were reviewed. Furthermore, drug related problems were identified and resolved. Assessed Drug Related Problems (DRP) were contra-indications, medication effectiveness, drug dosage and directions for use, drug interactions, and duplication of medication and inadequate duration of therapy, side effects, untreated indication, and monitoring.

The Personnel Medication Record (PMR) of patients were developed and updated based on information obtained from the Medication use review. Other information provided on this record were the names and phone number of patients, pharmacist name and contact numbers. For each medication the

name, indication, dosage, start date, stop date and any precautionary measures were also stated. Patients were educated on the PMR and encouraged to always have the PMR with them and share it with other healthcare personals whenever necessary.

A concordance approach was used to develop the Medication Related Action Plan. (MAP) Patients' views and perspective on their medicines and care were considered and incorporated into the plan. Furthermore, any recommendation made by the health care team was also incorporated into the plan. All actions patients had to take to ensure optimum blood pressure control with reference to medicines and lifestyle modifications were part of the plan.

Solutions to address medication related problem were discussed with the patient's physician and other health care personals. These solutions included recommending changes in therapy, adherence counselling, monitoring and patient education. These were incorporated into the medication related action plan.

The Subjective, Objective, Assessment, Plan and Outcome (SOAPO) (American College of Clinical Pharmacy, 2012) approach was used in documenting all the medication related problems and the appropriate solutions and outcomes. All patients in the intervention group were followed up every month for six months. Patients were also given a token to aid their transportation fares on each visit. This was done because the review periods to see the physicians at the hospital was varied (1 to 3 months) among participants. For some participants, review dates coincided with the follow-up meeting with the pharmacist for the MTM services while others had review periods that were far off. Furthermore, since this was a low literate population, the two pharmacists who offered the intervention were very fluent in the local dialect and as much as possible pictograms were used to aid counseling on medications prescribed.

### 5.5 Data Collection

Data was collected at baseline, every month and at the end of the study for a period of seven months. Patients in the study group were offered a CMR as described above at baseline. This was a face-to-face consultation with the patient. PMR and MAP as described above was also developed. Information documented through this process included demographic characteristics, medication and medical history, blood pressure measurements, medication related problems and interventions provided. Subsequent visits were then scheduled with patients. During subsequent visits medication use reviews were conducted, the PMR and the MAP were updated. Blood pressure measurements were documented.

The control group, received the routine medical care and reviews and also medication therapy review was offered at baseline. However only life threatening DRPs recommendations were discussed with them and their attending physicians. Information documented through this process included demographic characteristics, medication and medical history, blood pressure measurements, and medication related problem. No PMR and MAP were developed for patients in the control group. However, the end of study outcome measures was assessed in both the control and intervention group at the end of the study.

### 5.6 Analysis of Data

Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 24 software. Descriptive statistics was used to compare percentage changes within the study group and the control group. The PCNE V5.01 Drug Related Problems categorization forms were used to categorize the drug related problems identified, assign causes to the DRPs, offer interventions for their resolution and track the intervention for progress. (Foundation, 2003) DRPs were categorized into six main classes as follows: Adverse drug reaction problems, drug choice problems, drug interactions problems, dosing problems, drug use problems and a miscellaneous category. The Fisher's exact test was used to determine if there were any differences in the demographic and clinical characteristics between the study and control groups. The Wilks' Lambda test obtained from the general linear model (repeated measures) was used to determine if there were any differences in the systolic and diastolic blood pressure at baseline and the end of the study between the study and control groups. A paired samples t-test was conducted to determine whether there was a statistically significant mean difference between baseline and end of study systolic BP and diastolic BP. McNemar's test was also conducted to determine whether there was a statistically significant difference in the proportions of drug related problems (DRPs) at baseline and end of study within the study group. Statistical significance was set at p-value < 0.05.



## 5.7 Outcome Measures

Clinical outcomes were Systolic blood pressure, diastolic blood pressure, overall blood pressure control and the number of drug related problems (DRPs) in both study group and control group at baseline and end of study.

## 5.8 Ethical approval

Ethical approval was obtained from the Committee on Human Research Publication and Ethics - KNUST (CHRPE/AP/605/19). Written informed consent were also provided by all participants.

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