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Original Research

Prospective Interventional Study on Medication-related problems and Associated Factors among Patients with Hypertension at a Tertiary Care Hospital

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ABSTRACT

Introduction: The global burden of hypertension in 2030 was estimated to be 44% of the population, which is a 17% increase from the presentwith high mortality and morbidity effects. Medication-related problems (MRPs) in cardiovascular disease patients, especially among hypertension patients, were found to be high and a critical problem which is associated with high mortality, complication, prolonged hospital stay, compromised quality of life and increase health care cost.

Objective: To determine medication related problems and its predictors among hypertension patients on chronic follow-up at Tertiary Care Hospital.

Methods: A prospective interventional study was conducted among hypertension patients from December 2023 to July 2024 at Tertiary Care Hospital. Medication related problems were classified and identified based on pharmaceutical care network Europe drug classification tool version 9.0. Interventions were done through discussion with individual prescribers and patients. Consecutive sampling technique was used. Binary Logistic regression was used to identify independent predictors of medication related problems. Variables having *p-values*< 0.05 were considered statistically significant.

Results: Among 384 hypertension patients included in the study, 219 (57.1%) were male. The mean (SD) age was 49.06+17.79. Two thirds of study participants had at least one medication related problem. A total of 483 MRPs were identified among 231 (60.15%) patients. Treatment effectiveness related problem (55.48%) was the most common observed medication related problems. Alcoholism (AOR; 3.15, 95% CI [1.46–7.23]), stage II hypertension (AOR=2.77, 95% CI= [3.53–4.66]); comorbidity (AOR=2.88, 95% CI= [1.47–5.66]) and polypharmacy (AOR=3.07, 95% CI= [1.57–5.99]) were the independent predictors of medication related problems.

Conclusion: The prevalence of medication related problems was high among hypertensive patients. Alcoholism, stage II hypertension, comorbidity and polypharmacy were the predictors of medication related problems. Therefore, to overcome the problems, clinical pharmacists, physicians and other health care professionals have to work in collaboration.

Keywords: Medication Related Problems, Interventions, Hypertension

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INTRODUCTION

When your blood vessel pressure is 140/90 mmHg or above, you have hypertension. Although frequently, if left untreated, it can become dangerous.[1] According to the SBP/DBP criterion of >140/90 mm Hg, the prevalence of hypertension is 31% worldwide, which is nearly identical to the 31.9% prevalence in the US adult population (72.2 million individuals).[2] Currently, over 1.4 billion individuals worldwide suffer with hypertension, and by 2025, that figure is expected to rise to 1.6 billion.[3]

An incident or situation involving medication therapy that impedes intended health results is known as a medication-related problem (MRP).[4] Patients with hypertension frequently have MRPs, which raise the overall burden of healthcare costs and lead to morbidity, mortality, higher costs, a negative impact on the patient's quality of life, and longer hospital admissions.[3,5] Patients are likely at risk for

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MRPs because managing hypertension might be made more difficult by advanced age, various co-morbidities, and polypharmacy.[6] The most frequent MRP indicated the need for more medication therapy, indicating that hypertension patients are still not receiving the best care possible.[7] A systematic analysis conducted in Ethiopia revealed that MRPs for hypertension were greater than those for other medical illnesses. This is because hypertension is caused by taking many drugs, and having a comorbid condition has been associated with negative health outcomes, such as poor treatment adherence and drug interactions.[8]

As a member of the multidisciplinary team, the clinical chemist has the potential to lower MRPs.[9] An interventional study conducted in the United States of America (USA) revealed that following a clinical chemist's intervention, the average MRP decreased from 2.8 to 1.95.[10] Through medication reconciliation, MRP detection, and intervention implementation on identified MRPs, pharmacist-based services can enable patients with hypertension to comprehend and manage their complicated prescription regimens.[11] Additionally, pharmacist-based therapies can lower hospital stays, readmissions, and complications, improve clinical outcomes for patients with hypertension, and lower ER visit and readmission costs.[12]MRPs are the cause of unfavourable health outcomes for persons with hypertension and lead to a significant number of morbidities and deaths globally.[13] According to studies, up to 30% of hospital admissions are connected to MRPs[15], and one out of six individuals with chronic diseases visit health facilities as a result of MRPs.[14] MRPs can lead to patient morbidity and mortality, which is why they are relatively common in patients with hypertension.[16–18] The amount of MRPs and the clinical chemist's role in treating hypertensive patients in Ethiopia are not well understood. Healthcare providers can optimise medication therapy to save health costs, save lives, enhance health, lower morbidity and mortality, and improve quality of life by knowing the amount of MRPs among patients with hypertension.[19,20] Therefore, the purpose of this study was to determine MRPs and related variables among Tertiary Care Hospital hypertension patients.

METHODS AND PARTICIPANTS

This study was carried out at Tertiary Care Hospital between December 2023 and July 2024. Patients with hypertension visit the Tertiary Care Hospital's hypertension clinic for follow-up.

Patients with hypertension at Tertiary Care Hospital participated in a prospective interventional trial design. The source population consisted of all hypertension patients who were monitored at the Tertiary Care Hospital's chronic follow-up clinic. All hypertension patients who met the inclusion requirements and received follow-up care at the Tertiary Care Hospital's chronic follow-up clinic during the study period made up the study population. Patients with hypertension who were at least eighteen years old and willing to provide written consent were included. Patients with hypertension with incomplete medical records and those who passed away or were lost to follow-up were not included. Medication-related issues were the dependent variable. Sociodemographic (age, sex, marital status, educational attainment, residence, medication belief, cost coverage, occupation, and social drug use) and clinical (co-morbidity, stage of hypertension, aetiology of hypertension, class and number of drugs, duration of diagnosis [years], and laboratory investigation) characteristics are examples of independent variables. The single population proportion formula was used to calculate the sample size. The final required sample size was 182, taking into account the 50% MRP proportion (P) among hypertension patients, the 95% CI, and the 5% margin of error. Until the necessary sample size was reached, the consecutive sampling procedure was employed.

MRPs were categorised and documented using MRP categorisation. P1 pertains to therapy effectiveness, P2 to treatment safety, and P3 to additional issues. C1-drug selection, C2-drug form, C3-dose selection, C4-treatment length, C5-dispensing, C6-drug use process, C7-patient related, C8-patient transfer related, and C9-Others are the nine main domains for causes. Relevant information on patient demographics and clinical data was extracted using a structured data collecting method. The belief about medication questionnaire (BMQ) was used to measure medication belief. A patient's belief was deemed positive when the average sum of their 5-item medication necessity scale score was greater than their average 5-item medication concerns scale score; otherwise, it was deemed negative.[21] The Naranjo drug reaction probability scale, which has previously been standardised and verified, was used to evaluate ADR.[22] To check for drug-drug and drug-disease interactions, use Lexi Comb and Medscape's drug interaction checker. By contrasting patient care with recommended practices, MRPs were found.[23–25]

Both clinical and sociodemographic traits are included in the structured questionnaire material. Following data collection, a clinical chemist evaluated MRPs by reviewing the patient's treatment. By examining the prescription's appropriateness in terms of indication, dose, and safety as well as by evaluating patients' adherence, medication-related issues were found. The primary investigator and three senior clinical pharmacists conducted interventions by speaking with each prescriber and patient right away. For additional interventions, MRPs that were rejected were further addressed with senior physicians or residents.

Prior to being transferred into SPSS for analysis, the data was revised and verified for accuracy and consistency. Binary logistic regression was used in a bivariate analysis to evaluate the relationship between the independent variables and MRPs. In multivariate logistic regression analysis, factors with a *p-value*<0.05 were deemed spastically significant, and those with a *p-value*<0.25 in bivariate analysis were added.

RESULTS

The study participants' sociodemographic attributes. 110 (57.1%) of the 192 research participants in this study were men. The patients were 49.06 +17.79 years old on average. The majority of them, 78 (40.63%), were between the ages of 19 and 47. The majority of patients—134, or 69.79%—lived in rural areas. Of the participants, 111 (57.81%) had little formal education, 67 (56.1%) held positive beliefs, and more than half (101, 52.6%) were farmers. Table 1 shows that 106 (55.0) participants, or nearly one-third, had a family history of hypertension.

Clinical Characteristics of Study Participants

The majority of the 192 hypertension patients in the research (123, 64.1%) also had concomitant conditions. The leading causes of hypertension were CMP 46 (23.69%), CVD 48 (25%), and CKD 67 (34.89%). The majority of individuals, 111 (57.55%), had been

Table 1: Baseline Socio-Demographic Characteristics among Hypertension Patients at Tertiary Care Hospital, from December, 2023 to July, 2024.

Variables		No. of Resp.	Frequency (%)
Sex(male)		110	57.1
Age, years	(Mean ± SD)	0	49.06 ± 17.79
	19–47	78	40.63
	48–63	61	31.51
	≥64	54	27.86
Education allevel	No formal education	111	57.81
	Primary education	26	26.3
	Secondary education and above	31	15.89
Family history of hypertension	Yes	106	55
	No	87	45.1
Occupationalstatus	Unemployed	35	18.23
	Farmer	101	52.6
	Merchant	35	17.97
	Government employee	22	11.2
Marital status	Single	40	20.57
	Married	86	57.55
	Widowed or divorced	42	21.88
Variables		**No. of Resp.**	**Frequency (%)**
Residence	Urban	58	30.21
	Rural	134	69.79
Cost coverage method	Insurance	61	31.51
	Out of pocket	132	68.49
Social drug users	Khat chewers	56	29.17
	Alcohol consumers	39	20.31
	Smokers	44	22.92
Medication belief	Positive belief	105	54.68
	Negative belief	87	45.32

diagnosed with hypertension for less than five years. During the final seven months of the follow-up period, 62 (50.8%) of the participants had controlled blood pressure (SBP and/or DBP). The subjects' mean SBP and DBP values were 44 (± 5.5 SD) mm HG and 72 (± 8.75 SD), respectively. Comorbidity was present in slightly more than half (64, 52.0%) of the individuals; the most common conditions were DM 123 (64.1%) and CKD 48 (25%), as shown in Table 2.

Blood pressure (BP), complete blood count (CBC), heart rate (HR), respiratory rate (RR), haemoglobin (HGB), and white blood cell (WBC) are some examples of abbreviations.

Table 2: Clinical Characteristics among Hypertension Patientsat Tertiary Care Hospital, from December, 2023 to July, 2024.

Variables		No. of Resp.	Frequency (%)
Stage of Hypertension	Prehypertension	22	11.2
	Stage I	54	28.12
	Stage II	117	60.68
Etiology of Hypertension	Chronic kidney disease	67	34.89
	Cardiovascular disease	48	25
	CMP	46	23.69
	HHD	27	16.41
Comorbid condition	Diabetes mellitus	123	64.1
	Chronic kidney disease	35	28.03
	Acute kidney injury	23	18.7
	Coronary artery disease	18	14.63
	Heart failure	21	16.67
	Peripheral neuropathy	16	8.07
	Chronic pulmonary disease	12	5.98
Number of comorbidities	<3	45	61.6
	≥3	28	38.4
Duration of Hypertension diagnosis (years)	<5	111	57.55
	6–10	50	26
	>10	32	16.4
Laboratory investigation			
Serumel ectrolyte, N = 214	Potassium	4.2 ± 0.7	4.2 ± 0.7
	Sodium	136.2 ± 3.9	136.2 ± 3.9
RFT, N = 233	Creatinine	0.9 (0.68–1.28)	0.9 (0.68–1.28)
Vital sign	Systolic BP	116.4 ± 16.9	116.4 ± 16.9
	Diastolic BP	72.9 ± 10.3	72.9 ± 10.3
	HR	92.5 ± 14.7	92.5 ± 14.7
	RR	23 ± 7.8	23 ± 7.8
CBC, N = 231	WBC	7.7 ± 3.4	7.7 ± 3.4
	HGB	12.1 ± 2.7	12.1 ± 2.7
	Platelet	250.5 ± 100.8	250.5 ± 100.8

Study Participants' Past Medical and Medications History and Medication Involved in Medication Related Issues.

During the study period, 192 patients with hypertension were prescribed a total of 335 medications. There were averages of 1.18±0.82 medications per patient. The most often prescribed antihypertensive drugs were

diuretics 126 (65.62%), ACEI 121 (62.72%), and CCB 51 (26.565%). Hydrochlorothiazide 116 (60.41%) and enalapril 121 (62.72%) were the most often prescribed particular medications. 101 (67.15) of the subjects, or nearly two-thirds, had a high level of drug adherence. One antihypertensive medication regimen was prescribed to more than half 104 (53.9%) of the patients. Calcium channel blockers (CCBs) were around 71 (40.75%) and angiotensin converting enzyme inhibitors (ACEIs) were about 26 (13.74%), while diuretics were the most commonly seen medication classes engaged in MRPs, accounting for 67 (34.72%), of which 63 (36.41%) were hydrochlorothiazide (Table 3).

Related Problems

Out of the 192 patients with hypertension, 116 (60.15%) had MRPs, and 242 MRPs were found. There were 1.25± 1.18 MRP on average per patient. Of the patients with MRPs, 65 (61.93%) had one,

Table 3: Overall Distributions of Antihypertensive Drugs Classes and Common Drug Classes Implicated in MRPs Among "Study Participants at Tertiary Care Hospital Chronic Clinic Follow Up from December, 2023 to July, 2024.

Drug Class		**Frequency (n), Total N = 192**	**Percent (%)**
ACEIs	Enalapril	121	62.76
ARBs	Losartan	7	3.6
Drug Class		Frequency(n), Total N = 192	Percent (%)
BBs	Metoprolol Atenolol Propranolol	23.5	12.23
		3.5	1.8
		2	1.06
Diuretics	Furosemide	8	4.16
	Hydrochlorothiazide	116	60.41
	Spironolactone	2	1.06
CCBs	Amlodipine	51	26.56
Other	(hydralazine)	1	0.7
Duration of therapy (years)	<2	51.5	26.82
	2–4	83	43.22
	≥5	57.5	29.94
Adherence	Low	36	18.75
	Medium	50	26.02
	High	101	52.6
Anti hypertensive drug regimen	1	103.5	53.9
	2	52	27.08
	≥3	36.5	19.01
Common drug classes implicated in MRPs		Frequency (n), Total N= 346	Percent (%)
ACEIs	Enalapril	70.5	40.75
ARBs	Losartan	3.5	2.02
BBs	Metoprolol Atenolol Propranolol	5	2.89
		0.5	0.29
		1	0.57
Diuretics	Furosemide	4	2.31
	Hydrochlorothiazide	63	36.41
CCBs	Amlodipine	25.5	13.74

The Prevalence, Type and Causes of Medication

Table 4: Medication Related Problems and Causes of Medication Related Problems among Patients with Hypertension at Tertiary Care Hospital from December, 2023 to July, 2024.

Primary Domain	**Code V9.1**	**Problem**	**No. of Resp.**	**Frequency (%), N = 242**
P1 Treatment effectiveness	P1.1	No effect of drug treatment despite correct use Effect of drug treatment not optimal Untreated symptoms or indication	49	20.29
	P1.2		22	9.1
	P1.3		13	26.1
P2. Treatment safety	P2.1	Adverse drug event (possibly) occurring	56	22.98
P3. Other	P3.1	Unnecessary drug-treatment	36	14.9
	P3.2	Unclear problem/ complaint	16	6.42
Cause domain, total = 654			0	Frequency (%)
Primary Domain			**No. of Resp.**	**Frequency (%), N = 242**
C1 : Drug selection causes			55	16.67
New indication for drug treatment In			34	10.24
appropriate drug according to guidelines			10	2.9
Contra-indicated			4	1.07
No indication for drug			3	0.92
In appropriate combination of drugs, drugs and foods In appropriate duplication of therapeutic agents			3	0.92
			2	0.61
C2:Drug formcauses Inappropriate drugform			17	5.04
			17	5.04
C3: Dose selection causes Dosage regimen not too frequent Drug dose too high			34	10.24
Drug dose too low			16	6.62
Dosage regimen too frequent			9	2.59
			5	1.52
			4	1.65
C4 : treatment duration causes Duration of treatment too long			1	0.51
			1	0.15
C5 : Dispensing causes Prescribed drug not available			4	1.07
			3	0.76
Necessary information not available			1	0.41
C6 : Drug use process causes Drug under administered			9	2.59
			6	1.68
Inappropriate timing of administration Drug not administered tall			2	0.45
			2	0.45
C7 : Patient related causes			32	9.63
Patient unable to understand instructions Patient takes less drug than prescribed Patient takes more drug than prescribed In appropriate timing or dosing intervals Patient uses unnecessary drug			17	5.04
			9	2.59
			4	1.07
			3	0.76
			1	0.15
C8 : Other causes			15	4.68
not safe or drug-drug interaction			9	2.59
No or in appropriate out come monitoring			7	1.98

28 (26.67%) had two, and 23 (21.42%) had more than three. Treatment effectiveness (no effect of drug treatment, untreated indication, effect of drug not optimal) accounted for 134 (55.48%) of the most frequently found MRPs. These were followed by others (necessary drug treatment, compliance, and cost effectiveness related) 56 (22.97%) and safety (ADE occur or may occur) 52 (21.57%). The causes of MRPs were found to number 654. The most frequent causes of MRPs were drug selection (55, 16.67%), dose selection (34, 10.24%), and patient-related (32, 9.63%) (Table 4).

Intervention, Acceptance Rate and Outcome of Intervention of Medication Related Problems

A total of 229 interventions were given at various levels to the identified MRPs; of these, 99 (43.23%) were carried out at the prescriber level, and 211 (91.92%) were approved. Following intervention, 201 (87.55%) of the issues were resolved, while 19 (10.26%) remained unresolved (Table 5).

Table 5: Intervention, Prescriber Acceptance Rate and Outcome of Intervention for MRPs Among Hypertension Patientsat Tertiary Care Hospital, December, 2023 to July, 2024.

Intervention Domain (N = 242)	No. of Resp.	Frequency (%)
I1 : Intervention at prescriber level	99	40.99
Intervention proposed and discussed with prescriber Prescriber informed only	72 28	29.6 11.38
I2 : intervention atpatient level Patient drug counseling	75 40	30.05 16.56
Spoken to family member/caregiver	35	14.42
I3 : Intervention at drug level	55	22.77
Drug stopped	19	7.86
New drug started	14	5.59
Formulation changed	12	4.96
Drug changed	7	2.69
Instruction for use changed	3	5.45
Dosage changed	1	1.81
Intervention acceptance domain (N = 229)		
A1 : Intervention accepted	211	91.92
Intervention accepted and fully implemented	180	78.6
Intervention accepted and partially implemented	16	7.36
Intervention accepted but not implemented	10	4.75
Intervention accepted, implementation unknowns	5	2.37
A2: Intervention not accepted	19	8.08
Not accepted; unknown reason	11	56.76
Not accepted; no agreement	8	43.24
Problem status domain (N = 229)		
O1 : Problem totally solved	201	87.55
O2 : Problem not solved	19	10.26
Lack of cooperation of prescriber	14	78.97
No need/possibility to solve problem	5	27.02
O3 : problem partially solved	3	1.31
O4 : Problem status unknown	2	0.8

Predictors of Medication Related Problems

Sex, age, comorbidity, alcohol consumption, chit chewing, stage of hypertension, and polypharmacy were revealed to predispose HF patients for MRPs with statistically significant associations in a crude analysis using binary logistic regression. Multivariate logistic regression was used to identify independent variables for detected MRPs. Lastly, it was discovered that the following factors were independent predictors of MRPs: polyp-pharmacy (AOR; 2.94, 95% CI 1.54–5.61, p = 0.02), presence of comorbid conditions (AOR: 2.59, CI 1.35–4.96, p = 0.004), stage II hypertension (AOR; 2.77, 95% CI 1.93–7.37, p = 0.001), and alcohol drinker (AOR; 3.25, 95% CI (1.46–7.23), p = 0.004).

Our results showed that patients with stage II hypertension were 2.77 (AOR; 2.45, 95% CI 2.32–5.34) times more likely to experience MRP than those without the condition, and that patients with comorbid conditions were 2.59 (AOR: 2.59, CI 1.35–4.96) times more likely to experience MRP than those without comorbid conditions. Alcohol-drinking hypertension patients were 3.25 (AOR; 3.25, 95% CI (1.46–7.23) times more likely to experience MRPs than non-smokers (Table 6).

DISCUSSION

Sixty-two percent of the 115 (60.15%) patients who developed MRPs were male, which is consistent with the findings of two Indian studies.[28,29] This may be because men were more likely than women to utilise medications due to comorbid conditions, as well as other risk factors like smoking, drinking, and chewing khat. The average MRP per patient was 1.25 1.18 and the prevalence of MRP was 60.15%, which was lower than the MRPs of 2.6 1.8 and 83.5 percent found in a study at a tertiary care hospital. This difference may have resulted from the different study setting, where our study involved chronic follow-up patients with more frequent access to clinical chemists and senior physicians.[20] Nonetheless, it is nearly consistent with research at TASH (65.5%)[26] and GUH 63.4%, or 1.17 ± 1.1 on average per patient.[30]

In our investigation, treatment effectiveness-related difficulties accounted for 134 (55.48%) of the most frequent MRPs, while ADE incidence was the least common (21.57%). Suboptimal pharmacological therapy and untreated indications accounted for almost 28% and 25% of treatment effectiveness-related issues, respectively. This result was consistent with a study carried out in Barcelona that revealed a risk of ADE occurrence of 16 percent and poor medication therapy of 31 percent.[31] On the other hand, a 2014 study at JUSH revealed that treatment effectiveness was roughly 83%, with inadequate medication therapy and untreated indications accounting for roughly 55% and 27% of this, respectively.[20] Additionally, a study on outpatient heart failure conducted in the United States revealed that issues related to treatment effectiveness were approximately 36.8%.[32] The disparity may result from variations in the study design, sample size, study environment, or MRP categorisation techniques.

Medication compliance was about 91% of patients, which was similar to a research conducted in the Netherlands (98.6%).[33] The 9% non-adherence rate was consistent with research conducted at JUSH's ambulatory care facility (9%), Harar (12%),[34] and Barcelona and Spain (14%).[20,31] But according to a TASH research, non-compliance

Table 6: Predictors of MRPs among Hypertension Patients at Tertiary Care Hospital, December, 2023 to July, 2024.

Variable	MRP Status		COR (95%CI)	*p*-value	AOR (95%CI)	*p-value*
	Yes	No				
Sex						
Male	37.24	76	1	0.049	1.17(0.56–2.45)	0.681
Female	56.1%	77(42.5%)			1	
Age group						
<47	45.9%	34(42.5%)	1		1	
48–63	31.8%	21(26.3%)	1.12 (0.59 – 2.16)	0.725	1.06(0.49 – 2.29)	0.875
>64	22.3%	25(31.2%)	0.66 (0.34 – 1.27)	0.216	0.52(0.24 –1.12)	0.097
Residence	70.1%)	61(76.2%)	0.73 (0.39 – 1.35)	0.32		
Alcohol drinker	31.8%	12(15%)	2.648 (1.316 – 5.33)	0.006	3.25(1.46 – 7.23)	0.004
Khatchewing	15.3%	7(8.7%)	1.88(0.77 – 4.58)	0.16	1.48(0.49 – 4.41)	0.478
Smokers	17.8%	10(12.5%)	1		1	
Payment method						
Insurance	31.2%	22(27.5%)	1		1	
Out of pocket	68.8%	58(72.5%)	0.84(0.461 – 1.52)	0.56		
Medication belief						
Positive belief	958.6%	41(51.3%)	1		1	
Negative belief	41.4%	39(48.7%)	0.74(0.43 – 1.28)	0.282		
Comorbidity	72.6%	32(40%)	3.98(2.25 – 7.02)	<0.001	2.59(1.35 – 4.96)	0.004
Polypharmacy	75.8%	32(40%)	4.69(2.64 – 8.37)	<0.001	2.94(1.54 – 5.61)	0.001
<5days	45.9%	61(76.3%)	1	<0.001	1	<0.001
≥5days	54.1%	19(23.7%)	3.79(2.07 – 6.93)		2.77(1.93 – 7.37)	
Stage of Hypertension						
Pre-Hypertension	7.8%	13(3.39%)	1	0.28	1	0.076
Stage I Hypertension	15.1%	50(13%)	8.78(2.53 – 3.66)		1.77(2.35 – 4.52)	
Stage II Hypertension	123(32.0%)	110(28.6%)	2.77(3.53 – 4.66)	<0.001	1.87(2.4 – 3.53)	<0.000

was almost 45%.[19] The discrepancy may be the result of different methods used to assess compliance; in our study, patients may have had greater access to information about medication from carers and health professionals; a problem with patients' adherence to non-pharmacological therapy or self-care activities; or the patient was not instructed in or did not comprehend non-pharmacological therapy or self-care advice in earlier studies.

Inappropriate medication selection accounted for one-third of MRPs in our sample, whereas issues with dosage selection accounted for roughly 21%. About 60% of cases involved indication (need additional drug therapy), which was higher than the study at GUH that found that inappropriate drug selection and new indication were roughly 36% and 59%, respectively,[30] and that inappropriate drug selection was 34% and dose selection was 27% in India.[35] Nonetheless, a study on the general medical problems of elderly patients admitted to Tertiary Care Hospital, revealed that approximately 54% of them had improper medicine selection, with 36% of the causes being identified.[36]This disparity could result from variations in the study population, medical conditions, sample size, and methodology.

BBs and ACEIs were the most frequently implicated drug classes in MRPs in the current study (35%) and 25.3%, respectively, which was in contrast to studies at JUSH, where BBs and ACEIs were 34.4% and 24.8%, respectively,[20] Taiwan, where ACEI was approximately 21% ,[37] and the ambulatory clinic of TASH and chronic follow-up hypertension patients at JUSH, where BBs, ACEIs, and antithrombotic were the most frequently implicated drug classes in MRPs.[19,38]

Multivariate logistic regression revealed that polypharmacy, stage-II hypertension, drinking, and comorbidity were all independent predictors of MRPs. Our findings that patients with a history of alcoholism are at a higher risk of MRPs are supported by a study done in southern India. The tenable claim is that drunkenness and social drug usage interrupt patients' financial problems.[35]One of the independent predictors of MRPs among patients with hypertension after therapy at Tertiary Care Hospital was stage-II hypertension. Studies carried out in Saudi Arabia and Nepal[38–42]provided evidence for this. This could be because a patient's requirement for more medications increases as their stage of hypertension does, which raises the possibility of MRPs.

Other independent risk factors for MRPs in individuals with hypertension who received treatment at Tertiary Care Hospital were known as comorbidity. Studies conducted at GUH's ambulatory clinic and Tertiary Care Hospital[5,19,20,43,44] supplement the same. Patients with comorbidity may be more susceptible to MRPs because they are more likely to take more medications to treat other conditions, which may result in drug-drug interactions, disease-disease interactions, or both. Furthermore, a number of research carried out in various contexts supported the idea that polypharmacy was an independent predictor of MRPs.[5,19,20,23,39,43,45-47] It is possible due to more drugs prescription, which increases the risk of adverse events, drug-drug interactions, adherence issues, and expense.

To properly diagnose, address, and prevent MRPs, clinical chemists' involvement with chronic patients are essential. Our study found that the acceptance rate of treatments by clinical chemists was approximately

91.92%, with 87.55% of interventions being fully implemented and 82% of interventions completely resolving the issue. This outcome was in line with research conducted in Karnataka, India, and Southern India, which found that clinical chemists' acceptance rates were almost 97% and 96%, respectively.[28,24] Additionally, the acceptance and intervention rates of clinical pharmacists were almost two-thirds of MRPs.[25,48-54]

LIMITATION

Because the study only included people admitted to one hospital rather than a community-based one, it might not accurately represent the population as a whole. Furthermore, the study was not carried out to evaluate the intervention's efficacy.

CONCLUSION

According to our research, patients with hypertension at Tertiary Care Hospital had a significant prevalence of MRPs. Treatment effectiveness-related issues, which mostly include poor medication effect and untreated indication, were the most often found MRPs. It was discovered that polypharmacy, comorbidities, and extended hospital stays were independent predictors of MRPs. The rate of acceptance of clinical intervention was high.

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