ORIGINAL RESEARCH

Medication-Related Hospital Admission Among Patients Admitted to the Emergency Ward at the University of Gondar, North West Ethiopia: A Cross Sectional Study

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Background: Medication-related hospital admission (MRHA) is hospitalization due to drug-related problems. MRHAs have been reported to be on the rise in recent decades.

Objective: This study was aimed at determining the prevalence, patterns, and predictors of MRHA among patients visiting the emergency ward of the University of Gondar comprehensive specialized hospital, Ethiopia.

Methods: A cross-sectional study was conducted from June 1, 2022, to August 30, 2022 G.C. in the emergency ward at the University of Gondar Comprehensive Specialized Hospital. The AT-HARM 10 tool was used to collect data from participants who fulfilled the inclusion criteria. Data was entered into EpiData Manager 4.6.0.0 and was exported to Statistical Package for Social Sciences (SPSS) version 24 for analysis. Descriptive statistics were presented using frequency and percentage. Binary logistic regression was applied to identify factors associated with MRHAs with a 95% confidence level, and significance was declared at a p-value <0.05.

Results: The prevalence of MRHAs was 30.5% (95% CI = 27.7–36.4%). More than half (64.52%) of MRHAs were definitely preventable. The majority of MRHAs (48.39%) were severe. Non-compliance (41.12%), followed by untreated indication (26.61%) and adverse drug reaction (12.09%) were the most frequent causes of MRHAs. Renal impairment (AOR = 2.703, 95% CI: 1.29 to 5.663), chronic disease (AOR = 10.95, 95% CI: 4.691 to 25.559), history of traditional medication use (AOR = 2.089, 95% CI: 1.162 to 3.755), and history of hospitalization (AOR = 4.001, 95% CI: 1.98 to 8.089) were significantly associated with MRHAs.

Conclusion: MRHAs were substantially prevalent. Most of the MRHAs were definitely preventable. Renal impairment, chronic disease, history of traditional medication use, and history of hospitalization were predictors of MRHAs. At the university hospital, health care providers should strive to prevent and manage MRHAs appropriately.

Keywords: medication, admission, Gondar

Background

Patients have been admitted to hospitals due to medication-related problems over the past few decades. Most of the admissions resulted from either preventable or potentially preventable drug-related problems (DRP).[1]

A drug-related problem (DRP) is defined as an event or circumstance that involves a patient's drug treatment that actually, or potentially, interferes with the achievement of an optimal outcome.[2]

Some of the DRPs responsible for medication-related hospital admissions (MRHA) might be adverse drug reactions, inappropriate drug selection, noncompliance, untreated indications, and drug interaction.[3]

A recent systematic review revealed that the most common cause of DRPs was "drug selection" (80.38%) in the primary domain, with the common subdomains "inappropriate drug according to guidelines/formulary" (54.63%), "no or incomplete drug treatment in spite of existing indication" (8.73%), "no indication for drug" (7.55%) and "too many

different drugs/active ingredients prescribed for indication" (6.67%). Secondly, the cause of DRPs was reported in the primary domain "dose selection", accounting for 10.52% with the common subdomains "drug dose too low" (4.54%) and "drug dose too high" (4.06%).[4] A systematic review and meta-analysis done in Ethiopia showed that the "need for additional drugs" was the most frequently reported type of DRP, (33%), followed by "noncompliance", 21%.[5] Different studies have identified many factors for MRHA. As an example, old age,[1] female gender,[6] polypharmacy,[7] and the presence of comorbidities[6,8] are related.

A systematic review found that around 5–10% of hospital admissions were due to DRPs.[1] Another systematic review stated that the prevalence of drug-related hospital admissions varies from 1.3% to 41.3%. Among patients hospitalized related to medications, 2.7% died due to DRPs.[2]

In a study conducted in the Netherlands, among general and academic hospitals the total costs of medication-related hospital admissions in one year were €81 million and €14 million, respectively.[9] A study in Brazilian hospitals revealed that the mean per hospital visit treatment costs of emergency department visit rates due to drug-related morbidity were US $900 ± $1569 (range US $18–$10,847).[10] The annual estimated cost of MRHA in an Australian study was 1.4 billion Australian dollars.[11] In Africa, a study conducted in Nigeria stated that annually a total of 1.83 million naira (USD 15,466.60) was used up to manage patients admitted due to ADRs.[12]

According to a systematic review and meta-analysis done in Ethiopia, a high prevalence of drug-related problems occur at different stages of medication use process.[13] Low-income countries such as Ethiopia could experience various draw backs related to MRHA. Medication-related hospital admissions contribute to increased health-care costs, loss of productivity, lower patient satisfaction, low quality of life, and increased mortality.[2,14] Determining the prevalence, preventability, severity, and associated factors of medication-related hospital admissions might aid in minimizing adverse health outcomes.

Method
Study Design, Area, and Period
A cross-sectional study was conducted from June 1, 2022, to August 30, 2022 G.C in the emergency ward at the UoGCSH, located in Gondar town, northwest Ethiopia. The calculated flying distance from Addis Ababa, the capital city of Ethiopia, to Gondar, is equal to *262* miles, which is equal to 421 km, and the driving distance between Addis Ababa and Gondar is 727.22 km.[15] The University of Gondar Comprehensive Specialized Hospital is a tertiary care facility with different wards, including emergency, ambulatory, pediatrics, oncology, gynecology, and surgery wards. According to the UoGCSH's 2022 G.C. annual report, around 280,000 patients visited the hospital and 12,000 are admitted to the emergency ward.

Population, Inclusion, and Exclusion Criteria
Patients aged ≥ 18 years admitted to the emergency ward at UoGCSH were the source population. However, those adult patients admitted to the emergency ward at UoGCSH during the study period were the study population. All adult patients admitted to the emergency ward with complete medical history data were included in the study. Patients with intentional medication poisoning, intoxication with chemicals and/or presented with trauma and injuries associated with accidents were excluded.

Sample Size Determination and sampling Procedure
The sample size was determined using a single population proportion formula with the assumption of a 95% confidence level, 5% margin of error, and 60% population proportion was used. This was obtained from a recent study conducted at the emergency ward.[16]

$$n = z^2 p(1-p)/w^2$$

$$n = (1.96)^2 (0.6 \times 0.4)/ (0.05)^2 = 368.79$$

By adding a 10% non-response rate (368.79*10% = 36.87) to the calculated sample size, 406 patients were estimated for the study. Where n = sample size, p = sample proportion/population proportion, z = confidence level/Z- score, and w^2= margin of error.

Patients who fulfilled the inclusion criteria were subjected to a systematic random sampling technique. During the four-month data collection period, 4000 patients were estimated to be admitted to the emergency ward. The formula "k=N/n" was used to obtain the "k" value. The "k" value became "10", and then a lottery method was used by rolling a piece of paper one through ten and randomly selecting one of the rolled papers to choose the first study participant. Then every tenth patient admitted to the ward was taken as a sample.

Variables of the Study

The dependent variable was medication-related emergency ward admission. The independent variables include age, marital status, patients with uncorrected/uncorrectable visual impairment, patients with uncorrected/uncorrectable renal impairment, patients that had chronic illness, patients with a history of traditional medication use, patients that had a history of hospitalization, number of medication the patient was using before admission, and duration of treatment for medication used before admission.

Operational Definitions

MRHA: If patient's medical record at admission was stated as medication-related or if the patient is admitted due to one or more DRPs including (non-compliance, untreated indications, improper drug selection, subtherapeutic dosage, failure to receive drugs, overdosage, ADRs, drug interactions, and drug use without indication.[17,18] Non-MRHA: If the admission was caused by

an infection or a previously undiagnosed disease, progression of a previously diagnosed disease that is not medication-related, physical trauma, substance intoxication and social circumstances or allergies that are not medication-related.[19]

Definitely preventable: If the patient avoids taking a drug that is recognized to reduce or avert the symptoms according to the prescriber supervision, had a known allergy to the medication, had a disease for which the drug was contraindicated, and took unindicated mediation.

Potentially preventable: where sufficient monitoring within a given time preludes DRPs.

Not preventable: If the mediation-related event could not have been avoided by any reasonable means, or it was an uncertain occurrence in the course of treatment fully in congruence with good medication utilization.[18,20]

Severity was considered "mild": if a laboratory abnormality or the symptom did not require medication intervention.

Severity was considered "moderate": if a laboratory abnormality or symptom that required medication intervention at the emergency ward.

Severity was considered "severe": if the symptom required hospital admission and was life-threatening (difficult to gain a rapid intervention using medication).[6,14]

Data Collection Instrument, Procedure, and quality Control

To collect the data, two pharmacists were trained on the data collection tool. Patients who fulfill the inclusion criteria and were willing to participate were assessed based on the tool when they are admitted to the emergency ward. Socio-demographic data were obtained based on previous similar studies. A tool that was developed at Uppsala University Hospital, Sweden, was used to identify medication-related admissions and related variables. AT-HARM10 tool consisting of ten closed questions was used to distinguish between admissions that are unlikely to be and those that are possibly medication-related.[19] Preventability of MRHA was assessed according to the modified version of G. T. Schumock and J. P. Thornton's preventability criteria.[21]

Part of the questionnaire that needed the response of patients (the socio-demographic data, patient's interview questions regarding drug therapy use) was translated into the local language (Amharic), and then they were interviewed. Then it was back translated into the English version to confirm translation consistency. Clinical information was gathered from patient medical records (procedure notes, physician orders, prescription papers, medication administration records,

physician progress notes, pertinent laboratory reports, and nursing progress notes). Estimated glomerular filtration rate (eGFR) of patients was calculated using the Cockcroft-Gault equation.[22] For patients with renal impairment, "Drug Prescribing in Renal Failure" was used as a guide to determine the appropriateness of the drug dose prescribed.[23]

After the questionnaire was pre-tested on 5% (20 individuals) of the study population, some rearrangements were made to the tool for appropriate data collection. The data collectors were trained for two days on the study objectives and how to use the questionnaire properly. Data collectors were supervised while collecting data. The data was checked for its completeness and consistency on a daily basis.

Analysis of Data

After data was entered, cleared, and checked with EpiData Manager 4.6.0.0, it was exported to Statistical Package for Social Sciences (SPSS) version 24 for analysis. The normality of the different variables included in the analysis was checked using histograms and the Shapiro–Wilk test. Descriptive statistics were used to characterize dependent and independent variables. The frequency and percentage of socio-demographic characteristics, clinical characteristics, and variables that measure MRHA were analyzed. Categorical variables were described as frequency and percentages, and continuous variables as the median and interquartile range (IQR). Tables and figures were used to summarize and describe the results.

To test the strength of association between dependent and independent variables, variables having a p-value <0.2 in bivariable binary logistic regression analysis were entered into multivariable binary logistic regression. The Hosmer–Lemeshow goodness of fit test was used to check model fitness. Chi-square test was used to see the association between two variables. All variables obeying the assumption of independence were analyzed later by multivariable binary logistic regression. Multicollinearity was assessed before the analysis and variables with the variance inflation factor (VIF) ranging from 1–1.8 were included.[24] In addition, the presence of outliers was checked using the interquartile range method (Q1-1.5*IQR and Q3+1.5*IQR).[25] There were no outliers in the data. Furthermore, the strength of association was measured using an odds ratio (OR). A p-value of < 0.05 was considered statistically significant with a 95% level of confidence.

Result

Socio-Demographic Data

From a total of 406 study participants, the median age of study participants was 40 years (IQR: 28–55). More than half (54.4%) of participants were female. Most of the patients (52%) were married. Beyond two-third (72.7%) of participants were rural residents. Regarding educational level, more than half (56.9%) of patients could not read or write. Majority (82.5%) of patients live with their families. A scanty number of patients (3.4%) had a smoking habit and less than half (45.6%) of patients had a drinking habit (Table 1).

Patients' Clinical and Medication Related Data

Patients were assessed at admission of which 11.6% had visual impairment and 16% had renal insufficiency. More than one-third (36.7%) of participants had chronic disease that were diagnosed before admission to the emergency ward of UoGCSH.

Around one-third (32.5%) of patients had a history of traditional medication use. Less than half (46.1%) of study participants had a history of hospital admission, and more than two third (63.1%) of them were hospitalized within 3 up to 6 months (Table 2).

Hypertension (14.28%) followed by diabetes mellitus (10.59%) were the most common history of diagnoses for patients who were admitted to the emergency ward (Figure 1).

The median number of medications used before admission was 2 (IQR: 1–3). The median duration of treatment before admission was 36 months (IQR: 5–133 months). Among 121 patients who had used medication before admission, nearly one-third (29.75%) of patients used Furosemide (Figure 2).

Table 1 The Socio-Demographic Data of Patients Admitted to the Emergency Ward at UoGCSH, from June 1, 2022, to August 30, 2022 G.C

Socio-demographics		Frequency (%)
Gender	Male	185 (45.6%)
	Female	221 (54.4%)
Age	18–35	176 (43.3%)
	36–64	176 (43.3%)
	≥65	54 (13.3%)
Marital status	Married	211 (52%)
	Single	125 (30.8%)
	Widowed	49 (12.1%)
	Divorced	21 (5.2%)
Residence	Rural	295 (72.7%)
	Urban	111 (27.3%)
Educational level	Can not read or write	231 (56.9%)
	Secondary education	57 (14%)
	Can read and write	48 (11.8%)
	Primary education	48 11.8%)
	College and above	21 (5.2%)
Living condition	Live with families	335 (82.5%)
	Live alone	67 (16.5%)
	Live in institution	4 (1%)
Smoking habit	Yes	14 (3.4%)
	No	392 (96.6%)
Drinking habit	Yes	185 (45.6%)
	No	221 (54.4%)

Prevalence and Patterns of Medication Related Hospital Admission

From a total of 406 admitted patients, MRHA was identified in 124 (30.5%) of study participants of which more than half (64.52%) were definitely preventable Regarding the severity, most (81.45%) of MRHAs were severe (Table 3).

Out of 124 MRHAs, most (41.12%) of them were due to non-compliance, followed by untreated indication (26.61%) and adverse drug reaction (12.09%) (Figure 3).

Among patients admitted due to medication, ninety-nine of them were on drug therapy. Of which more than three-fourth (79.79%) of them had regular follow-up at health care facilities. And more than half (60.6%) of patients get their medications paid. More than one-third (35.35%) of participants had a problem of remembering their medication regimen. Three-fourth (75.75%) of patients does not have medications other than prescribed medications. More than half (53.54%) of participants had discontinued their medication without telling their doctors. The most common reason for patients to discontinue their medications was "feeling well" (35.85%) followed by ADR (24.53%) (Table 4).

Table 2 The Clinical Data of Patients Admitted to the Emergency Ward at UoGCSH from June 1, 2022, to August 30, 2022 G.C

Clinical Information		Frequency (%)
Psychological Disease	Yes	23 (5.7%)
	No	383 (94.3%)
Visual impairment	Yes	47 (11.6%)
	No	359 (88.4%)
Hearing impairment	Yes	25 (6.2%)
	No	381 (93.8%)
Renal insufficiency	Yes	65 (16%)
	No	341 (84%)
Hepatic insufficiency	Yes	36 (8.9%)
	No	370 (91.1%)
Patients with chronic illness before admission	Yes	149 (36.7%)
	No	257 (63.3%)
History of traditional medicine	Yes	132 (32.5%)
	No	274 (67.5%)
History of hospital admission	Yes	187 (46.1%)
	No	219 (53.9%)
Hospitalization	With in 3 up to 6 month	118 (63.1%)
	With in 7 up to 12 month	35 (18.72%)
	>12 month	34 (18.18%)

Furosemide was the most common[16] medication associated with the DRP category non-compliance, followed by Amlodipine[2] and Enalapril[11] (Figure 4).

According to the multivariate logistic regression analysis, the variables renal impairment, chronic disease, history of traditional mediation use and history of hospitalization were significantly associated with the occurrence of MRHA.

Patients with renal impairment (AOR = 2.703, 95% CI: 1.29–5.663), patients with chronic disease (AOR = 10.95, 95% CI: 4.691–25.559), patients with a history of traditional mediation use (AOR = 2.089, 95% CI: 1.162–3.755), and patients with a history of hospitalization (AOR = 4.001, 95% CI: 1.98–8.089) were predictors of MRHA (Table 5).

Discussion

The findings of this scientific evidence would help to allay MRHAs not only at UGCSH but also in similar settings throughout the nation.

This study revealed a high prevalence of MRHA that was 30.5% (95% CI = 26.1–35). The result is consistent with a study done in Ethiopia[18] and Spain.[26] A much higher prevalence was observed in a study done in Ethiopia (57.9%)[16] and Sweden (41.3%).[6] The prevalence in the present study is lower than the study done in Ethiopia stated previously. This might be due to the current study was not a multicentre study design resulting in a lower percentage of prevalence. The present study does not assess the elderly population alone unlike the Swedish study. Drug-related problems are more predominantly experienced by the elderly population resulting in MRHA. Age-related physiologic changes associated
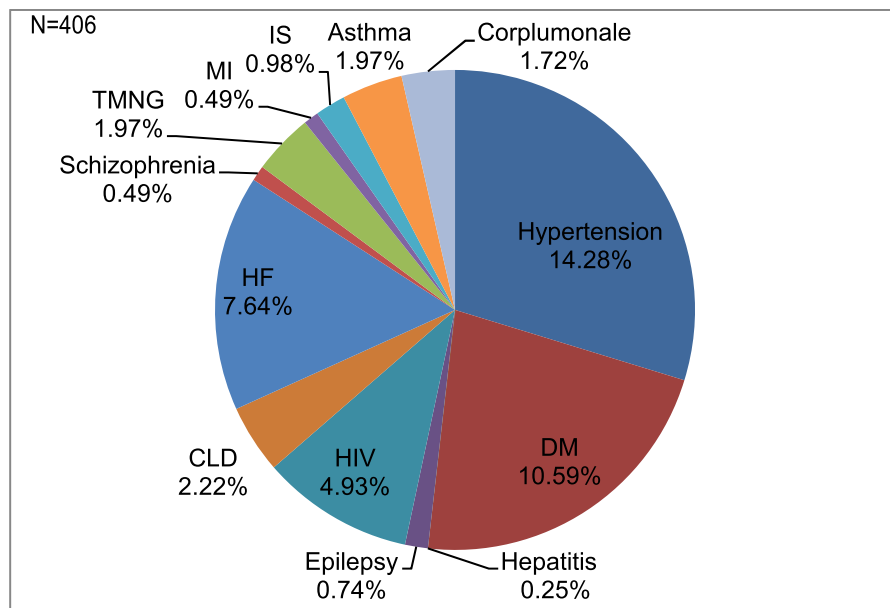
CLD - Chronic liver disease, DM - Diabetes mellitus, HF- Heart failure, HIV - Human immuno virus syndrome, IS - Ischemic stroke, MI - Myocardial infarction, TMNG - Toxic multinodular goiter.

Figure 1 Patient's history of diagnosis before they were admitted to the emergency ward at UoGCSH, from June 1, 2022 to August 30, 2022G.C.
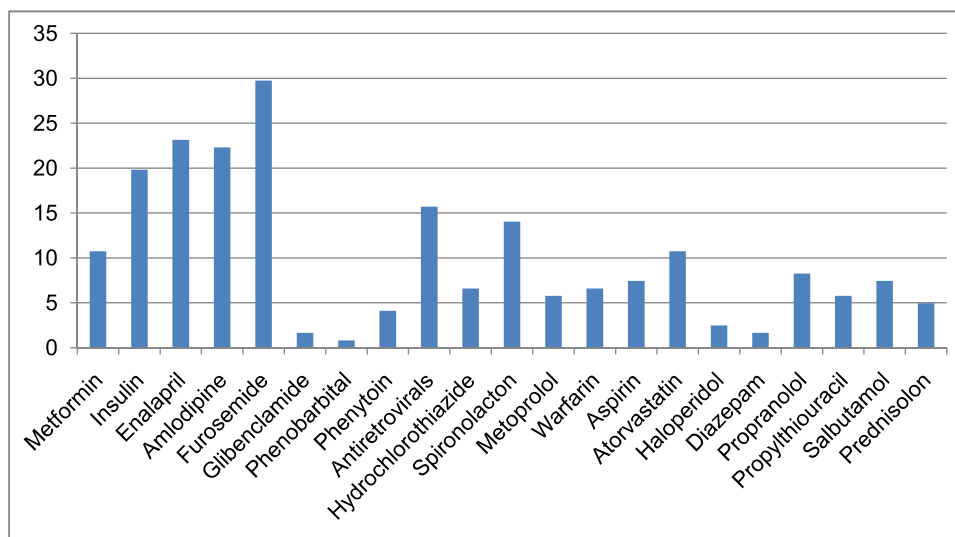
Figure 2 Medications used by patients before admission to the emergency ward at UoGCSH, from June 1, 2022 to August 30, 2022G.C.

pharmacokinetic and pharmacodynamics alterations, multi-morbidity and polypharmacy are more common in these population.[27]

Patients with chronic illness should be alert about the appropriateness of their mediation use. If not used properly it might lead them to be hospitalized frequently. This could give them a devastating economic consequence and a compromised quality of life.[28]

Table 3 Patterns of MRHAs Among Patients Admitted to the Emergency Ward at UoGCSH, from June 1, 2022, to August 30, 2022 G.C

Characteristics	Medication Related Hospital Admissions	Frequency (%)
Admission	MRHA	124 (30.5)
	Non-MRHA	282 (69.5)
Preventability	Definitely preventable	80 (64.52)
	Potentially preventable	37 (29.84)
	Not preventable	7 (5.65)
Severity	Mild	2 (1.61)
	Moderate	21 (16.94)
	Sever	60 (48.39)
	Fatal	41 (33.06)

The current study revealed 64.52% (95% CI = 56.5–73.4) of MRHAs were definitely preventable. Similarly a study in Ethiopia[18] revealed the majority of MRHAs were definitely preventable. By contrast a study done in the Czech Republic,[29] Australia,[11] and Canada[30] showed the majority of MRHS were potentially preventable According to the present study finding, patients usually refuse to take medications as prescribed by physicians and patients do not seek therapy even if they have a condition that requires drug therapy. These reasons would result in definitely preventable MRHA. Compliance with mediation is mandatory for a patient to achieve desired treatment outcome.[31] In addition ignorance or some disease by itself might not allow a patient to receive treatment despite being necessary.[32] Medical teams should create awareness about the benefits of being compliant and taking the required treatment to patients on a regular during their arrival of taking medications (Mediation refill). Patients should take responsibility to improve their health condition by visiting health facilities if necessary and be adhered to medication.
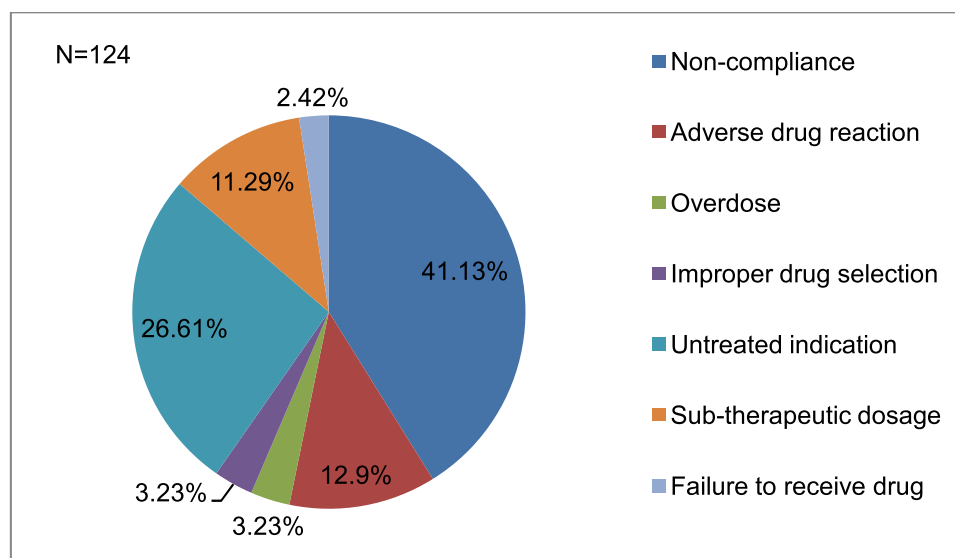

Figure 3 The DRP categories among patients with MRHA admitted to the emergency ward of UoGCSH from June 1, 2022 to August 30, 2022G.C.

Table 4 Medication-Related Information of Patients Who Have Been on Drug Therapy Before Admission to the Emergency Ward at UoGCSH from June 1, 2022, to August 30, 2022 G.C

Medication Related Information		Frequency (%)
Patients who have regular follow-up	Yes	79 (79.79%)
	No	20 (20.2%)
Way of getting treatments	Paid	60 (60.6%)
	Free	39 (39.39%)
Patients having a problem of remembering their medication regimen	Yes	35 (35.35%)
	No	64 (64.65%)
Patients that have medication/s other than prescribed medication/s	Yes	25 (25.25%)
	No	74 (74.75%)
Patients discontinue medications without telling their doctors	Yes	53 (53.54%)
	No	46 (46.46%)
Reasons for drug discontinuation	"Feeling well"	19 (35.85%)
	Adverse drug reaction	13 (24.53%)
	Cost	10 (18.87%)
	Thinking medication may not work	7 (13.21%)
	other	4 (7.55%)

In the present study the most common category of DRP that result in MRHA was noncompliance, 41.4% (95% CI = 33.1–50). This result is similar with studies done in Ethiopia,[16,18] India,[33] and Saudi-Arabia.[34] In this study most patients discontinued their mediation when they were "feeling well" 35.85%. The clinical data showed that the majority of
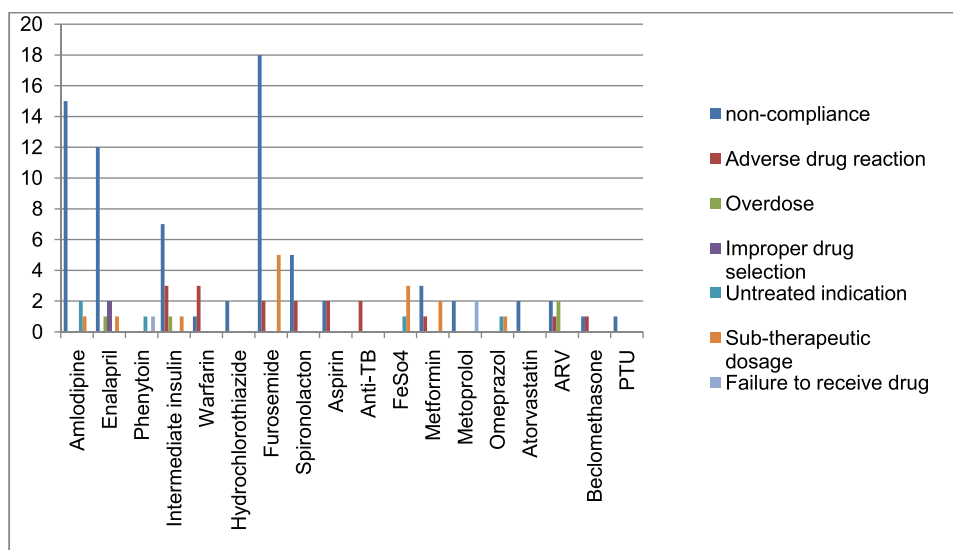
ARV - antiretroviral drug, FeSo4 - Ferrous sulfate, PTU - Propylthiouracil, TB - Tuberculosis

Figure 4 Lists of medications that patients were taking associated with DRP categories at the emergency ward of UoGCSH from June 1, 2022 to August 30, 2022G.C.

Table 5 Factors Associated with MRHA in the Emergency Ward at UoGCSH from June 1, 2022, to August 30, 2022 G.C

Variables		Presence of MRHA		COR (95% CI)	AOR (95% CI)	P-value
		No	Yes			
Age (in years)				1.024 (1.011–1.037)	0.997 (0.975–1.019)	0.789
Marital status	Single	99	26	1	1	
	Married	142	69	1.85 (1.101–3.109)	1.652 (0.768–3.552)	0.199
	Widowed	31	18	2.211 (1.072–4.559)	2.333 (0.723–7.532)	0.156
	Divorced	10	11	4.188 (1.605–10.929)	1.509 (0.439–5.186)	0.513
Patients with uncorrected/uncorrectable visual impairment	Yes	20	27	1.816 (0.976 −3.382)	1.312 (0.55–3.126)	0.540
	No	104	255	1	1	
Patients with uncorrected/uncorrectable mobility impairment	Yes	14	14	2.436 (1.124–5.28)	0.652 (0.237–1.788)	0.405
	No	110	268	1	1	
Patients with renal impairment	Yes	29	36	2.086 (1.212 −3.592)	2.703 (1.29–5.663)	0.008*
	No	95	246	1	1	
Patients with chronic disease	Yes	94	55	12.932 (7.8–21.442)	10.95 (4.691–25.559)	<0.001*
	No	30	227	1	1	
Patients with a history of traditional medication use	Yes	48	84	1.489 (0.957–2.317)	2.089 (1.162–3.755)	0.014*
	No	76	198	1	1	
History of hospitalization	Yes	102	85	10.745 (6.348–18.188)	4.001 (1.98–8.089)	<0.001*
	No	22	197	1	1	
Number of medication used before admission				1.85 (1.519–2.254)	0.829 (0.591–1.163)	0.279
Duration of treatment for medications used before admission (in months)				1.006 (1.002–1.011)	0.997 (0.992–1.003)	0.376

Note: *Statistically significant value.

patients have a chronic disease that needs life-long treatment[35] despite feeling well. Patients with chronic diseases need frequent medical monitoring and counseling with their prescribers not to discontinue their mediation.[36] The second most common reason for discontinuation of treatment was due to ADRs. Patients discontinue their medication when noxious drug reactions are experienced. To minimize drug discontinuation patients need to be reassured about possible ADRs before they take their medications.[37] Clinical pharmacists could review patients' medical charts, interview patients about their medication use practice, ask if they need any clarity about how to use their medications and, identify as well as monitor ADRs in hospital wards. By doing so, clinical pharmacists would have a role in early detection, reporting, and prevention of drug-related problems.[38]

The current study found that renal impairment was significantly associated with MRHA. Patients with renal impairment experienced nearly 3 times more MRHA than patients without renal insufficiency [AOR: 2.703, 95% CI: (1.29 −5.663), $p = 0.008$]. This is consistent with the studies done in Norway[39] and Australia.[40] Inappropriate drug dose adjustment and medication choice might lead renal impaired patients to frequent admission to hospitals.[41] ADRs resulting from inappropriate medication use are common in patients with renal insufficiency and older population as their organ functions are compromised, which could result in hospitalization.[42] Close monitoring of renal function, appropriate dose adjustment and drug selection are required in patients with renal insufficient to minimize the frequency of hospitalization and improve quality of life in those patients.

The present study revealed that patients with chronic disease experienced about 11 times more MRHA than patients without chronic [AOR: 10.95, 95% CI: (4.691–25.559), p < 0.001]. Similarly studies conducted in Ethiopia,[18] Spain,[43] and Norway[20] found that patients with chronic disease are at higher risk of MRHA. Patients with chronic disease could take multiple medications for a long period of time to control their disease progression.[44] Patient with chronic disease might not be compliant to medications and could experience ADR that result in MRHAs. Attention should be given to patients with chronic disease that have multiple medications to avoid drug interactions and subsequent ADRs.[45] Patients with poly-pharmacy might also forget taking their medication regimen that could be difficult to manage with their chronic health condition. Patient education and good professional interaction would be beneficial to increase medication adherence. Health care professionals should optimize benefits and decrease harms during medication use process in chronic disease patients. To achieve treatment goals, patient preference and individualized management should also be considered.[46]

In addition, this study also found that patients with a history of traditional medication use experienced 2 times more MRHA than patients with no history of traditional mediation use [AOR:2.089,95% CI: (1.162 −3.755), p = 0.014].

Traditional medications are not well studied and have not passed through different clinical trials to be used widely to treat disease.[47] Using these medications could put patients in the position of "untreated indication" that the patient might have a disease not treated properly. It also has an effect on compliance since patients might hold or substitute their drug therapy thinking that the traditional medications would cure them.[48] In addition, traditional medications do not have scientifically known dose range, intervals, contraindications, and interactions. Therefore, during treatment of certain disease patients consume them inappropriately that could result in adverse events.[49] Patient education is important to avoid or minimize the use of traditional medications. As they are not well studied, patients might end up in complications as their conditions are not treated well. Patients who used such medication should undergo organ function tests and blood monitoring to prevent and treat any intoxication.[50]

Furthermore, the current study showed that patients with a history of hospitalization experienced 4 times greater MRHA than patients without a hospitalization history [AOR: 4.001, 95% CI: (1.98–8.089), p < 0.001].

During hospitalization patients receive prescription medications according to their disease conditions. After an improvement, patients will be discharged from a hospital with their medications that are continued to be taken at home.[51] Having those medications, patients with a history of hospitalization could experience ADRs that might lead patients to be readmitted to hospitals.[52] In the present study most patients were noncompliant with their prescription drugs. These could result in poor disease prognosis causing the patients to be admitted to hospitals repeatedly.[53] Health care professionals should advise patients with a history of hospitalization to be adherent to their medication. Especially for patients with chronic disease conditions that discontinue medication upon feeling well. Patients should be reassured about possible ADRs to prevent drug discontinuation.[54] They should also be informed to seek medical advice and treatment for any of their health conditions.

Strength and Limitations of the Study

Efforts were made to assess the prevalence, patterns, and associated factors of MRHAs with quality data collection. Due to the fact that adults as well as African populations were assessed, the study population has heterogeneity concerns, which could affect generalizability. In addition, the submission of the work was late due to political instability that caused a loss of internet connection at the time of manuscript writing in the northern part of Ethiopia.

Conclusions

Medication-related hospital admission had a meaningful prevalence at the emergency ward of UoGcSH. Most MRHAs were identified to be definitely preventable noncompliance to prescribed medication followed by untreated indication and ADRs were the most common reason for MRHA. Renal impairment, chronic disease, history of traditional medication use and history of hospitalization were predictors of MRHA. The high prevalence could affect the quality of life of patients and the economic wellbeing of the health care setting.

Recommendations

To reduce MRHAs the hospital should give caution to health care professionals to provide patients appropriate mediation therapy. Rapid intervention should be given to patients who are admitted to the hospital due to medication-related problem. An emphasis should be given to pharmaceutical care as it would help in answering patients' questions regarding drug-related needs. Incorporation of clinical pharmacists in hospital settings helps in prevention and identification of drug-related problems and minimize the number of patients that are admitted to hospitals related to medications. Health care professionals should educate patients about the importance of seeking medical treatment if there is an indication and mediation compliance. Health care providers should identify patient groups who are likely susceptible t to ADRs to adjust treatment choice accordingly. Patients need to be reassured about ADR of their prescribed medication. Health care providers should give a close follow-up to patients with renal impairment, chronic disease, a history of traditional medication use, and a history of hospitalization.

Abbreviation

ADRs, Adverse drug reactions; AOR, Adjusted odds ratio; DRPs, Drug-related problems; eGFR, Estimated glomerular filtration rate; MRHA, Medication-related hospital admissions; UoGcSH, University of Gondar comprehensive and specialized hospital; VIF, Variance inflation factor.

Data Sharing Statement

All relevant data are in the manuscript. Extra data which form the basis for this study are accessed upon reasonable request from the corresponding author.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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