Evaluation of WHO Drug use Indicators, Prescription Errors, and Patterns of Polypharmacy: A Cross Sectional Study in Bangladesh

By

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A thesis submitted to the School of Pharmacy in partial fulfillment of the requirements for the degree of
Bachelor of Pharmacy

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Declaration

It is hereby declared that

1. The thesis submitted is my own original work while completing degree at BRAC University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

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Approval

The project titled "Investigation of prescription error pattern in Bangladesh" submitted by Monjila Khatun Mukta (ID: 19346080) of Spring, 2020 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelors of Pharmacy on May 2025.

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Ethics Statement

The study was completed according to the Declaration of Helsinki and the World Medical Association's (WMA) guidelines. The intention of the study was explained to the outpatients of Bangladeshi hospitals, clinics, and chambers to collect prescription pictures from the patients after verbal consent. Personal information confidentiality was maintained, and data were used just for research purposes.

Abstract

This study aimed to evaluate prescribing patterns in Bangladesh, which is focus on drug–drug interactions, polypharmacy, and irrational prescribing practices to identify areas for improvement in medication management. 993 prescriptions were analyzed, with participants comprising 47.2% males and 52.5% females, selected from various regions of the country. Data analysis was performed using SPSS version 26. WHO drug indicators were investigated, average number of drugs, 3.91%, prescribed antibiotics (66.06%),illegible handwriting 58 (5.84) %, absence of prescriber name 649 (65.35) % and the drug-drug interaction were found 251 (25.28) %, Different groups of government hospitals, private clinics, and hospitals showed a significant difference ($p \leq 0.001$), the ANOVA test indicated significant differences in the healthcare section ($p < 0.001$) and the age groups ($p < 0.001$) based on drug-drug indication. Polypharmacy showed a significant difference age group ($p < 0.05$), drug-drug interaction showed a significant difference healthcare section ($p \leq 0.001$), and the age group 51-65 also differed to >65 ($p \leq 0.017$) as determined by the LSD Post Hoc Test. The findings underscore critical shortcomings in rational prescribing, highlighting the urgent need for targeted policy, training, and system-level interventions to improve medication safety in Bangladesh.

Keywords: Prescription error, polypharmacy, drug-drug interaction, rational use of drugs, irrational use of drugs.

Dedication

Dedicated to my parents.

Acknowledgement

First of all, I thank my Almighty for good health and for giving me the determination to complete this project. I am always thankful for that. I want to thank my project supervisor, Kazi Milenur Rahman Prattay (Lecturer, School of Pharmacy). I am grateful for all his guidance, recommendations, suggestions, and support throughout the project. He genuinely advises me on each and every part of this study. I also highlight some of my friends specially Ramisa Anjum, Salwa Mahfuz Noha, Fariha Tasneem, Pranto Podder, Ashfaqur Rahman, Mahmud Al Maruf, Suha Sharafa and Atia Jinnat Promi for their constant support. Without their support, I cannot complete my project on time. I am really grateful for them. I also thank the Acting Dean, Professor A F M Yusuf Haider, PhD (Professor and Dean, School of Pharmacy, BRAC University), for ensuring that our project was completed and submitted on time. Lastly, I showed heartfelt gratitude to my parents because without their support, I would not have completed my graduation.

Table of Contents

List of Tables

List of Figures

List of Acronyms

WHO	World Health Organization
BNF	British National Formulary
AMR	Antimicrobial resistance
ADRs	Adverse drug reactions
MEs	Medication errors
PD	Pharmacodynamic
RUM	Rational use of medicine
ICU	Intensive care unit
PK	Pharmacokinetic
PPMS	Prescription pattern monitoring studies
ADME	Absorption, distribution, metabolism, or elimination
SPSS	Statistical Package for the Social Sciences

Chapter 1

Introduction

1.1 Background

Medicines play a vital role in healthcare systems; however, when they are unavailable or used irrationally, it undermines patient trust, decreases healthcare worker morale, and erodes public confidence (Mulwa et al., 2015). Irrational prescription, which is described as not following to appropriate standards of care, is developing country. It raises healthcare expenses, increases the chance of adverse drug reactions (ADRs), and escalating antimicrobial resistance (AMR) problems (Mulwa et al., 2015). According to the WHO, over 50% of prescriptions, dispenses, and sales of pharmaceuticals are improperly prescribed, with this problem being especially common in low- and middle-income nation when 25–70% of healthcare spending are determined for medicine (Hogerzeil et al., n.d.). The World Bank, if estimates that antimicrobial resistance (AMR) is goes uncontrolled, the healthcare costs might approach $1 trillion annually, and global GDP losses could range from $1 trillion to $3.4 trillion (Antimicrobial Resistance, n.d.). National healthcare systems are also constrained by inappropriate prescribing. For example, according to one study, improper prescription procedures under a national health insurance program rapidly raised medical costs, highlighting a critical need to boost prescription standards (Ofori-Asenso & Agyeman, 2016). Especially in developing countries, inappropriate prescribing practices continue to be a global concern. An analysis of 180 outpatient indicated that patients typically took three medications, with low documentation rates and 43.8% of prescriptions being non-generically prescribed (Adebayo & Hussain, 2009). Worldwide Around 142,000 deaths for medication errors (Naghavi et al., 2015). However, overuse of antibiotics has raised healthcare expenses, extended hospital stays, and increased the number of deaths from resistant infections (Llor & Bjerrum, 2014). In 2019, antimicrobial resistance (AMR) was responsible for 1.27 million fatalities by 2022, it was related to 5 million deaths by 2050, it is predicted to cause 10 million deaths annually (Salam et al., 2023). In ICUs, 43% of patients were given the wrong antibiotics, and 21.6% of them died (Abdelkarim et al., 2023). This problem is made worst in underdeveloped nations by the widespread practice of self-medication, which is promoted by overpriced diagnostic fees and uncontrolled distribution (Demissie et al., 2022).

1.2 Prescription

Prescriptions are official written orders for medication or treatment from certified medical professionals that include details on the patient, prescriber and particular medication (Kumar et al., 2019). Depending on national laws, it may have a validity term in addition to the date and personal data of the patient and provider. Through investigation of prescribing, dispensing, and distribution procedures, Prescription Pattern Monitoring Studies (PPMS) aims to improve the Rational Use of Medicines (RUM). RUM provides that patients receive the right drugs at fair prices, with the right dosages, along with a proper period of time (Jain et al., 2015).

1.3 Error of Prescription

Prescription writing is guided by standards like the British National Formulary (BNF), WHO's manual, and Nepal's ethical codes, yet many doctors fail to adhere to them (Shrestha & Prajapati, 2019). Appropriate prescribing is vital for effective medication therapy and patient health (Ansari & Neupane, 2009). WHO developed indicators to evaluate rational drug use, focusing on essential medicines, polypharmacy, generic prescriptions, and the use of injections and antibiotics, widely applied in over 30 developing countries (Shrestha & Prajapati, 2019). Although Bangladesh produces quality medicines for global export, its healthcare system remains inefficient, with prescription errors being a major concern (Biswas et al., 2014). These errors are categorized into superscription, inscription, and subscription errors, ranging from missing patient details to incorrect dosages and illegible handwriting (Shrestha & Prajapati, 2019). Mainly Errors are two types: one is omissions (missing information) and another is commissions (incorrect information) (Shrestha & Prajapati, 2019). A Research indicates that in nations like the United Kingdom (UK), the United States (USA) and Saudi Arabia, prescription errors play a major role in adverse reactions and medication errors (Biswas et al., 2014). A study was conducted 2024 in Bangladesh revealed that both private and government hospital had significant rates of polypharmacy and omission errors, underscoring the necessity of strict observance to WHO prescribing recommendations (Samad et al., 2024).

1.4 Polypharmacy

The term "polypharmacy," which was invented more than 150 years ago, now it normally describes taking five or more medications at the same time (Cadogan et al., 2016). This strategy is associated with an increased risk of adverse effects, such as physical disabilities, fragility, and possibly even death. Studies was showed that polypharmacy, especially in elderly people, has been associated in studies to potentially incorrect prescribing and bad clinical outcomes that may threaten individual safety (Varghese et al., 2024).

1.5 Drug-Drug Interactions

The drug-drug interactions (DDIs) may happen Using several medications at once to address different medical diseases might cause negative side effects, reduced treatment effectiveness or unexpected reactions (Tornio et al., 2019). Categorized these interactions are into pharmacodynamic (PD) and pharmacokinetic (PK). While pharmacodynamic interactions happen when one medicine changes the impact of another, pharmacokinetic interactions include one drug influencing another's drugs absorption, distribution, metabolism, elimination (ADME) (Huang et al., 2007). In general, pharmacodynamic interactions can be categorized as antagonistic, synergistic or additive. antagonism happening when the combined effect is less than the total of the individual effects, synergy showing a combined effect larger than the sum, and additivity referring to the combined effect of the individual (Niu et al., 2019).

1.6 Rational Use of Medicines

Conception of the rational use of drugs, first introduced by Herophilus around 300 B.C., remains a cornerstone of effective healthcare (Almarsdóttir & Traulsen, 2005). WHO defined it in 1985 as prescribing drugs based on clinical need, correct dosage, appropriate duration, and affordability, the World Bank expands this by emphasizing evidence-based and cost-effective drug selection within national healthcare systems (How to Develop and Implement a National Drug Policy - World Health Organization, n.d.). RUM also considers patient-centered factors to ensure optimal therapeutic outcomes (Khalife et al., 2023).

1.7 Irrational Prescribing

Irrational medication use can lead to serious consequences, particularly for older adults and patients with comorbidities (Hamilton et al., 2009). Antibiotic misuse contributes to allergic reactions, toxicity, superinfections, and resistance, exacerbated in Bangladesh by unregulated access and overuse (Sutradhar et al., 2014). Improper prescribing, especially of painkillers, sedatives, and injections, increases risks of dependence and disease transmission (Aina et al., 2008). Patient misconceptions also drive unnecessary demand, increasing costs and resource waste (Ofori-Asenso & Agyeman, 2016b). WHO suggests that rational use can reduce healthcare costs by 50%–70% and recommends integrated educational, managerial, and economic strategies (WHO, 2008; Hogerzeil, 1995). In Bangladesh, poverty and weak regulation further drive misuse, with major contributing factors including lack of awareness (45%), financial pressure (34%), poor communication (39%), and regulatory gaps (15.8%) (Islam, 2017). Addressing these issues requires multifaceted, system-level interventions targeting both prescribers and patients.

1.8 Factors Influencing the Irrational Use of Medicines in Prescriptions

Irrational drug use arises from various factors, including workplace conditions, patient behavior, prescriber practices, and the drug supply system, such as industry regulation and misinformation (Mousavi et al., 2013; Ofori-Asenso et al., 2016). A major contributor is low patient awareness; individuals often pressure providers to prescribe unnecessary medications, particularly antibiotics. For instance, in 76 UK primary care institutions, 74% of patients received antibiotics for acute respiratory infections, with 44% of prescriptions driven by patient demand rather than clinical need (Md Rezal et al., 2015). Physicians may struggle to deny requests from vulnerable or familiar patients (Sumon et al., 2024). On the prescriber side, inadequate training, limited continuing education, and resource constraints in low-income settings contribute to outdated or irrational practices (Ofori-Asenso & Agyeman, 2016a). Poor infrastructure, lack of diagnostic tools, and time pressures further exacerbate the issue, as shown by a Ghanaian study where over 90% of doctors rarely ordered tests due to time limits (Ofori-Asenso et al., 2016; Polage et al., 2006). Moreover, the lack of standard prescribing protocols and frequent medication shortages contribute to inappropriate drug use. Lastly, pharmaceutical marketing plays a substantial role; frequent interactions with medical representatives can lead to the over-prescription of expensive and unnecessary drugs due to biased information and personal relationships (Allan et al., 2007).

1.9 Aim and Objective

This project seeks to analyze prescribing patterns in Bangladesh to uncover the true extent of irrational prescribing practices in the country. Ultimately, it helps to find the following objectives:

- To analyze the prescribing patterns in Bangladesh, including drug-drug interactions, irrational Prescribing practices and instances of polypharmacy are crucial for understanding the current situation of medication management and identifying areas for improvement.

- To determine what type of errors are shown in each prescription and investigate whether Bangladeshi hospitals are following the WHO guidelines.

Chapter 2

2. Methodology

2.1 Study Procedure and Design

The project was designed as a cross-sectional prescription survey across multiple districts in Bangladesh, including Dhaka, Savar, Gazipur, Rangpur, Faridpur, Rajbari, Madaripur, Gaibandha, Mymensingh, Narail, Magura, Pabna, Rajshahi, and Cox's Bazar. This study aimed to understand the prescription patterns and errors and evaluate the outdoor prescription in our country. Furthermore, the goal was to understand the rational and irrational use of drugs in Bangladesh.

2.2 Duration of Data Collection

The study was conducted in multiple districts in Bangladesh between 3rd March 2024 and 4th January 2025.

2.3 Data Analysis and Management

For data collection, prescriptions were captured at various hospitals, clinics, and chambers after patient consultations and stored in Google Drive to prevent duplication. The prescription data were then manually entered into Microsoft Excel (2021) for organization and analysis, and subsequently imported into SPSS version 27. The number and percent of multiple segments of data, such as combination drugs, drug-drug interactions, antibiotic use, total drug count, and polypharmacy, were analyzed. Data were categorized based on the presence or absence of errors (Yes/No). Only nominal data was used for the associations, and numeric data was avoided during the analysis. all, managerial and economic strategies

Chapter 3

Result

3.1 Socio-demographic profile of the study participant

A total of 993 participants responded in the survey, 47.2% male, and 52.5% female. A large number of responders were between 31-50 years' age (32.9%), and the maximum participant was from the government hospital (Table 1).

Variable	**Category**	**Frequency n (%)**
Gender	Male	469 (47.2)
	Female	521 (52.5)
	Total	990 (99.7)
Healthcare Section	Government hospital	725 (73.0)
	Private clinics and hospitals	138 (13.9)
	Private chambers	130 (13.1)
	Total	993 (100)
Age group	<13	82 (8.3)
	13 – 30	319 (32.1)
	31 – 50	327 (32.9)
	51 – 65	173 (17.4)
	>65	71 (7.2)
	Total	972 (97.9)

Table 1: Socio-demographic profile of the study participant

3.2 Prescription Indicators Study Using WHO Core Indicators

This study 993 prescriptions evaluated to prescription writing practices in comparison with WHO standards. Average number of drugs was per prescription 3.91, surpassing the WHO-recommended range of (1.6–1.8) %, indicating it as polypharmacy. Here, the lowest number of use the generic name of drugs (0.1) % between the others indicators. Antibiotics were prescribed in 66.06% of the cases, significantly exceeding the WHO standard of (20–26) %. The use of injections was observed in 3.22% of prescriptions, which falls within the recommended range (Table 2).

Prescribing indicators assessed	Current study value	WHO standard
Average number of drugs per prescription	3.91	1.6 – 1.8%
Percentage of Drug prescribed with a generic name	0.1	100%
Percentage of Prescription with an antibiotic	66.06	20 – 26.8%
Percentage of Encounters with an injection	3.22	13.4 – 24.1%

Table 2: Prescription indicators study using WHO core indicators

3.3 Prevalence of Prescription Errors

This study showed that the errors of prescription such as illegible handwriting 58 (5.84) %, absence of prescriber name 649 (65.35) % and signature 256 (25.78) %, date not mentation 14 (1.4) %, generic name not use 992 (99.89) % and the drug-drug interaction were found 251 (25.28) % (Table 3).

Type of error	Frequency of error (%)
Errors of omission by the prescriber	
Illegible handwriting	58 (5.84)
Patient's name was not mentioned	2 (0.20)
Age not mentioned	13 (1.3)
Prescription date was not mention	14 (1.4)
Prescriber's name/qualification not mentioned	649 (65.35)
Prescriber signature was not mentioned	256 (25.78)
Errors of omission by drugs per prescription	
Dose not mentioned	100 (0.000)
Diagnosis not mentioned	340 (34.23)
Frequency not mentioned	100 (0.000)
Generic name not mentioned	992 (99.89)
Errors of commission	
Drug-drug interaction	251 (25.28)

Table 3: Prevalence of prescription errors

3.4.1 Average Number of Drugs Per prescription Vs Type of Healthcare Section

Number of average drugs per prescription, the government hospitals (3.33%), private clinics and hospitals (5.44%), private chambers (5.55%). Among the different groups of government hospitals, private clinics, and hospitals, there is a significant difference ($p \leq 0.001$) was determined by the LSD Post Hoc Test. We found significant mean differences between the government hospital to private clinics and the hospital and the government hospital to private chambers (Figure 1).

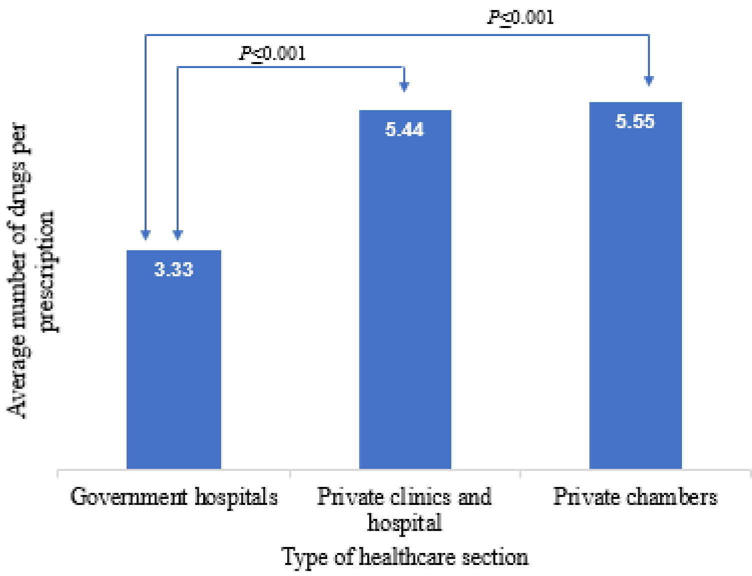

Figure 1: Average number of Drugs per prescription vs Type of Healthcare Section

3.4.2 Average Number of Drugs Per Prescription Vs Age Group

Average number of drugs based on different age groups <13 (3.62%), 13-30 (3.66%), 31-50 (3.96%), 51-65 (4.23%), and >65(4.61%). Among the different age groups <13 significantly differ to age group 51-65 (p<0.017) and >65 (p≤0.001), age group of 13-30 differ to 31-50 (p<0.049), 51-65 (p<0.002) and >65 (p≤0.001), age group 31-50 also differ to >65 (p < 0.009) Determined by the LSD Post Hoc Test (Figure 2).

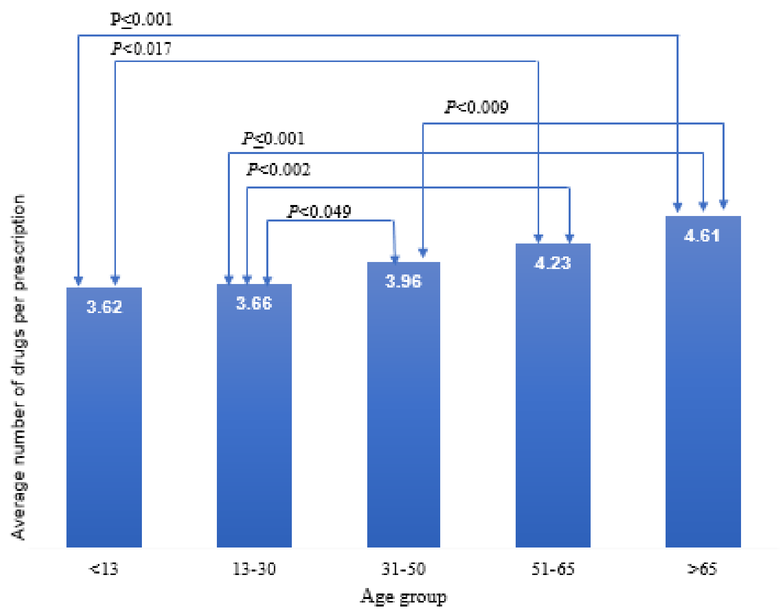

Figure 2: Average number of drugs per prescription vs Age group.

3.5.1 Polypharmacy with Socio-demographic variables

Among the genders, polypharmacy was significantly more prevalent in males (28.14%) and females (35.76%). Polypharmacy is present among the Groups in government hospitals (17.67%), private clinics and hospitals (48.98%), and private chambers (71.53%), with a 1:4:7 ratio. respectively; $p \leq 0.001$). For the age group of >65 (46.48%), there was a higher use of polypharmacy among different types of age groups. Polypharmacy vs. non-polypharmacy is (311.95% vs 147.18%), based on healthcare section and age group. The degree of freedom ratio of polypharmacy and drug-drug interaction was the same (2:4), and the Pearson chi-square value for healthcare section (254.369%), age group (15.511%). There was a significant difference ($p < 0.05$) in the age group (Table 4).

Variables	Characteristics	No (%)	Yes (%)	df	Pearson x2 value	p-value
Gender	Male	337 (71.86)	132 (28.14)	1	6.571	<0.010
	Female	334 (64.23)	186 (35.76)			
Healthcare section	Government hospital	596 (82.32)	128 (17.67)	2	254.369	<0.001
	Private clinic and hospital	41 (29.71)	97 (48.98)			
	Private Chambers	37 (28.46)	93 (71.53)			
Age group	<13	63 (76.83)	19 (23.17)	4	15.511	<0.004
	13-30	229 (71.78)	90 (28.21)			
	31-50	220 (67.28)	107 (32.72)			
	51-65	105 (61.04)	67 (38.96)			
	>65	38 (53.52)	33 (46.48)			

Table 4: Polypharmacy with socio-demographic variables

3.5.2 Drug-Drug Interaction with Socio-Demographic Variables

Analysis of variance (ANOVA) on various variables based on polypharmacy with gender of participants indicated statistically significant differences was ($p<0.010$) across different respondents by age group ($p< 0.004$) and healthcare section ($p<0.001$) (Table 3). Here based on drug-drug interaction, the ANOVA test indicated significant differences in healthcare section was ($p <0.001$) and the age groups ($p < 0.001$). Healthcare section and age group were significantly different ($p<0.001$) based on drug-drug interaction. Drug-drug interaction is present among the Groups in government hospitals (14.90%), private clinics and hospitals (52.17%), and private chambers (54.62%), with a 1:5:5 ratio. respectively; $p < 0.001$). For the age group of >65 (42.25%), there was a higher use of drug-drug interactions among different types of age groups. The Pearson chi-square value for healthcare section (153.461%), age group (22.674%). ($p < 0.001$) was a significant difference observed among the age group and healthcare section (Table 5).

Variables	Characteristics	No (%)	YES (%)	df	Pearson x2 value	p-value
Gender	Male	360 (76.76)	109 (23.24)	1	2.102	<0.147
	Female	379 (72.74)	142 (27.25)			
Healthcare section	Government hospital	617 (85.10)	108 (14.90)	2	153.461	<0.001
	Private clinic and hospital	66 (47.83)	72 (52.17)			
	Private chambers	59 (45.38)	71 (54.62)			
Age group	<13	67 (81.71)	15 (18.29)	4	22.674	<0.001
	13-30	259 (81.19)	60 (18.81)			
	31-50	236 (72.17)	91 (27.83)			
	51-65	122 (70.52)	51 (29.48)			
	>65	41 (57.75)	30 (42.25)			

Table 5 : Drug–Drug interaction with socio-demographic variables

3.6.1 Drug-Drug Interactions Vs Types of Healthcare Section

The analysis revealed significant differences in the mean number of drug-drug interactions between government hospitals, private clinics, and private chambers. Specifically, government hospitals had a mean of 0.26%, private clinics and hospitals 1.92%, and private chambers 2.22%. Statistical analysis using the LSD Post Hoc Test confirmed a significant difference ($p \leq 0.001$) among these healthcare section (Figure 3).

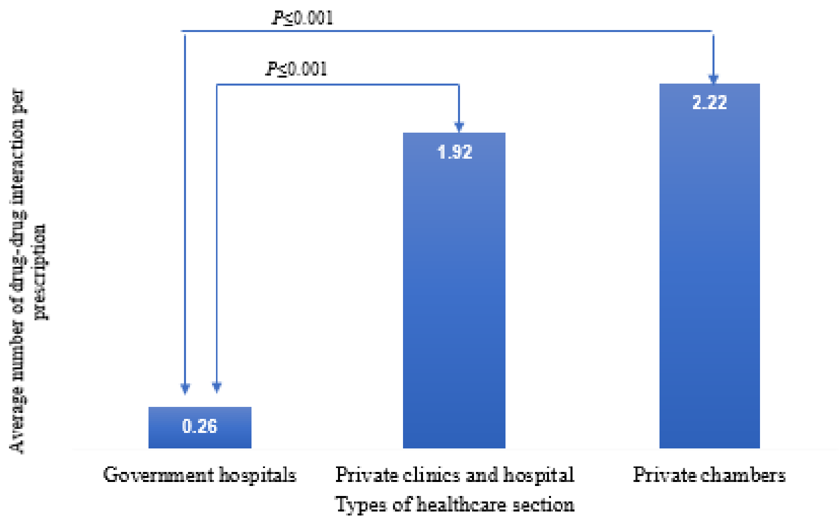

Figure 3: Average Number of Drug-Drug Interactions per prescription Vs Types of Healthcare Section

3.6.2 Drug-Drug Interactions Vs Age Group

Average drug-drug interactions based on different age groups is <13 (0.22%), 13-30 (0.39%), 31-50 (0.84%), 51-65 (1.1%), and >65(1.8%). Among the different age groups <13 significantly differ to age group 31-50 ($p<0.016$), 51-65 ($p<0.002$), and >65 ($p\leq0.001$), here age group of 13-30 differ to 31-50 ($p<0.006$), 51-65 ($p\leq0.001$) and the >65 ($p\leq0.001$). The age group 51-65 also differ to >65 ($p<0.017$) Based on the LSD Post Hoc Test results (Figure 4).

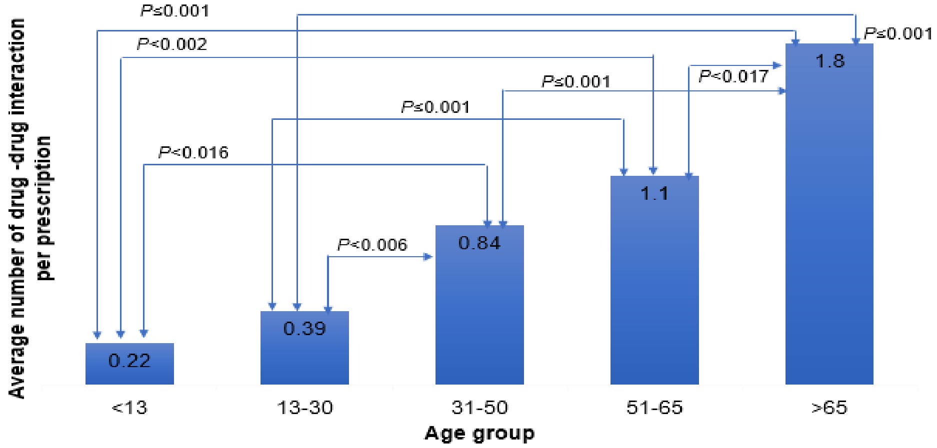

Figure 4: Average number of drug-drug interactions per prescription vs age group

3.7.1 Generic Drugs Prescribed from Different Therapeutic Class

Total number to drug class of vitamin and supplements use (47.63%), analgesic, antipyretic and anti-inflammatory (37.26%), antibiotics drug use (34.64%), antihistamine (15.30%), antispasmodic (6.94%), respiratory (20.74%), gastrointestinal (45.01%), ayurvedic and herbal (0.74%), cardiovascular (1.51%), antifibrinolytics (0.80%), Antiviral (0.70), anti-platelet (3.22%), antidiabetic (3.62%) and miscellaneous (2.92%). So, here vitamin and supplements (47.63%) and gastrointestinal (45.01%) therapeutic class of drugs is used with a higher number of prescriptions among others, the ratio is (4:4) (Table 6).

Therapeutic class	Frequency of generic drugs prescribed	Frequency of prescription n (%)
Vitamins and supplements	Calcium Dobesilate (3), Calcium carbonate (38), Rosuvastatin Calcium (32), Elemental Calcium (44), Vitamin A (2), Vitamin C (16), Vitamin B complex (121), Vitamin D (180), Multivitamin (34), Ferrous Sulfate (3)	473 (47.63)

Analgesics, antipyretics, and anti-inflammatory, and antianginal	Naproxen (50), Ibuprofen (9), Mefenamic acid (2), Nabumetone (9), Ranolazine (2), Dexibuprofen (2), Paracetamol (268), Ketorolac Tromethamine (28)	370 (37.26)
Antibiotic	(Phenoxymethyl Penicillin [Penicillin V] (5),Amoxicillin (3),Flucloxacillin (31), Ciprofloxacin (15),Cefixime Trihydrate (62), Cefuroxime (45), Ceftriaxone (6), Cefpodoxime Proxetil (2), Cefaclor (3),Cefditoren (21),Cephradine (8),Ceftibuten (1),Clarithromycin (5),Mupirocin (8)Metronidazole (1), Moxifloxacin Hydrochloride (14),Rifaximin (3), Azithromycin Dihydrate (30),Nitrofurantoin (4), Linezolid (2), Levofloxacin Hemihydrate (10), Doxophylline (65),	344 (34.64)
Antihistamine	Fexofenadine (106), Bilastine (31), Cetirizine Hydrochloride (11) Azelastine (4)	152 (15.30)
Gastrointestinal	Esomeprazole (372), Rabeprazole (49), Pantoprazole (26)	447 (45.01)
Antispasmodic	Tiemonium Methylsulfate (69)	69 (6.94)
Respiratory	Salbutamol (40), Montelukast (166),	206 (20.74)
Cardiovascular	Nitroglycerin (14), Levamlodipine Maleate (1),	15 (1.51)
Antifibrinolytics	Tranexamic Acid (8)	8 (0.80)
Antiviral	Acyclovir / Valacyclovir (7)	7 (0.70)
Antiplatelets	Clopidogrel (11), aspirin (21)	32 (3.22)
Anti-diabetic	Metformin (17), Glimepiride (6), Linagliptin (13)	36 (3.62)
Miscellaneous	Tolperisone (15), Albendazole (4), Acetylcysteine (8), White Kidney Bean Extract (1), Sulfasalazine (1),	29 (2.92)

Table 6:Generic drugs Prescribed from Different Therapeutic Class

3.7.2 Prescription of Combination Drugs

Among combination drug prescriptions, the most frequently used therapeutic class was vitamins and supplements (54.20%), followed by antibiotics (16.82%), respiratory drugs (12.71%), analgesics, antipyretics, and anti-inflammatory agents (9.15%), gastrointestinal drugs (7.66%), cardiovascular drugs (7.29%), miscellaneous drugs (7.66%), antidiabetics (3.55%), dermatological and sexual health drugs (2.05%), and ayurvedic/herbal medicines

(0.74%). Notably, vitamins and supplements were prescribed at a significantly higher rate than antibiotics, with a usage ratio of approximately 1:5 (Table 7).

Therapeutic class	Combination drugs prescribed	Frequency of prescription n (%)
Antibiotics	Cefuroxime + Clavulanic Acid (1), Cefuroxime Axetil + Clavulanic Acid (45), Ciprofloxacin + Dexamethasone (1), Cefdinir + Lactobacillus (1), Cinchocaine + Hydrocortisone + Framycetin + Esculin (1),amoxicillin + Clavulanic Acid (26), Gentamicin + Hydrocortisone Acetate (2), Fusidic acid + Betamethasone (1), Fusidic acid + Hydrocortisone (8), Sulphamethoxazole + Trimethoprim (1), Lansoprazole + Amoxicillin + Clarithromycin (1),Ofloxacin + Ornidazole + Terbinafine (2),	90 (16.82)
Vitamins, supplements	Vitamin B1, B6 & B12 (80), Vitamin B Complex + Zinc (27), Iron Polymaltose Complex + Folic Acid + Zinc Sulfate (4), Carbonyl Iron + Folic Acid + Zinc Sulfate (4), Zinc Sulfate Monohydrate (14), Folic Acid + Zinc Sulfate Monohydrate (3), Multivitamin & Multimineral (25), Calcium Carbonate + vitamin D3 (1), Coral Calcium + Vitamin D3 (80), Ibandronic Acid & Calcium Orotate (1), Algae Calcium + Vitamin D3 (16), Calcium Citrate + Calcitriol (2), Eggshell Calcium + Vitamin D3 (14), Calcium Phosphate [Milk source] + Vitamin D3 (3), Elemental calcium + vitamin D3 (1) Ferrous Ascorbate + Folic Acid + Zinc Sulfate (14), Calcium Lactate Gluconate + Calcium Carbonate + Vitamin C + Vitamin D3 (1),	290 (54.20)
Analgesics, antipyretics, anti-inflammatory	Paracetamol + Tramadol Hydrochloride (10), Naproxen Sodium + Esomeprazole Magnesium (10), Glucosamine Sulfate + Chondroitin (6), Permethrin + Crotamiton (10),Econazole Nitrate + Triamcinolone Acetonide (3), Clobetasol Propionate + Salicylic Acid (7), Undenatured Type-II Collagen + Hyaluronic Acid + Methylsulfonylmethean + Turmeric + Boswellia serrata (1), Diclofenac Sodium + Methyl Salicylate + Linseed Oil + Menthol (2),	49 (9.15)
Anti-diabetic	Empagliflozin + Linagliptin (5), Linagliptin + Metformin Hydrochloride (3), Glimepiride + Metformin (2), Empagliflozin + Metformin Hydrochloride (1), Sitagliptin + Metformin Hydrochloride (2),Vildagliptin + Metformin Hydrochloride (2), Insulin Aspart + Insulin Aspart Protamine (1), Regular Insulin Human + Isophane Insulin Human (3),	19 (3.55)
Skin and sex	Terbinafine + Itraconazole (1), Miconazole Nitrate + Hydrocortisone (1), Ketoconazole + Zinc Pyrithione (3), White Soft Paraffin + Liquid Paraffin (3), Cepalin + Allantoin (1), Liquid Paraffin + Benzalkonium Chloride + Chlorhexidine + Isopropyl Myristate (1),Coal Tar + Salicylic Acid + Aloevera (1)	11 (2.05)

Respiratory	Guaifenesin + Dextromethorphan + Menthol (2), Salmeterol + Fluticasone Propionate (27), Budesonide + Formoterol Fumarate (18), Mometasone Furoate + Formoterol Fumarate (4), Formoterol Fumarate + Glycopyrrolate + Budesonide (3),Indacaterol + Glycopyrronium (7), Dextromethorphan+ PhenylephrineTriprolidine (4), Vilanterol Trifenatate + Fluticasone Furoate + Umeclidinium Bromide (3),	68 (12.71)
Gastrointestinal	Sodium Alginate + Sodium Bicarbonate + Calcium Carbonate (35), Aluminium Hydroxide + Magnesium Hydroxide + Simethicone (5), Magaldrate + Simethicone (1),	41 (7.66)
Ayurvedic and herbal	Apple Vinegar + Garcinia cambogia + Ginger Root + Cayenne Pepper (1), Glycerin + Aloevera + Olive oil + Milk powder (2), D-chiro-inositol + Myo-inositol (1)	4 (0.74)
Cardiovascular	Amlodipine Besilate + Olmesartan Medoxomil (18), Amlodipine Besilate + Atenolol (12), Bisoprolol Fumarate + Amlodipine Besilate (3), Telmisartan + Hydrochlorothiazide (2), Amlodipine Besilate + Telmisartan (4),	39 (7.29)
Miscellaneous	Estradiol + Dydrogesterone (1),Glycerol + Liquid Sugar (1), Ethinyl Estradiol + Lynestrenol (1), Drospirenone + Ethinyl Estradiol (1), Tolperisone + Lidocaine (1), Potassium Citrate + Citric Acid (3), Polyethylene Glycol 3350 + Electrolytes (1), Betamethasone + Neomycin Sulphate (2), Permethrin 1%+Sodium Benzoate 0.2% (1), Sodium Chloride + Dextrose (2), Rifampicin + Isoniazid + Pyrazinamide + Ethambutol (1), Diosmin + Hesperidin (1), Dextran + Hypromellose (2), Clioquinol + Flumetasone Pivalate (1), Furosemide + Spironolactone (17), Sodium Alginate + Potassium Bicarbonate (5),	41 (7.66)

Table 7:Prescription of Combination Drugs

Chapter 4

Discussion

This study focuses on identifying prescription pattern errors in Bangladesh, influenced by both inadequate treatment protocols and human factors. Such errors include incorrect dosages, inappropriate drug selection, irrational drug use, wrong frequency, medication oversight, illegible handwriting, poor communication, and omission of critical information. Data were collected from various healthcare settings, including government hospitals, private hospitals and clinics, and private chambers. The findings revealed notable deviations from WHO prescribing indicators. Both government and private institutions demonstrated high rates of omission errors and inappropriate prescribing, with polypharmacy being particularly prevalent in private settings. However, government hospitals exhibited a higher frequency of omission errors. Among the 993 participants, females comprised the majority (52.5%), and most participants were from government hospitals (73.0%). Here, 3.33 was the average number of drugs per prescription in government hospitals, 5.44 in private hospitals and clinics, and 5.55 in private chambers, all exceeding WHO recommendations for rational prescribing.

A 2024 study in Bangladesh reported an average of 5.16 and 5.87 drugs per prescription in government and private hospitals, respectively, exceeding WHO recommendations (Samad et al., 2024). In comparison, studies from Nepal and India reported lower averages (2.55 and 3.08, respectively), with a high percentage of prescriptions lacking generic names (J. T. M. Shrestha et al., 2021; Gujar et al., 2021). Both Bangladeshi hospital types also showed poor compliance with generic prescribing, contrasting with the WHO's 100% standard (WHO,2017).

The study found a high rate of omitted dosage (32.12%), with private hospitals (43.96%) and government hospitals (41.14%) both exceeding rates in Pakistan (9.3%) and Nepal (32.6%) (Samad et al., 2024). No frequency omissions were recorded in this survey, though previous local studies showed rates up to 10.39%, higher than those in Pakistan (7.3%) and Nepal (1.1%). Absence of physician signatures occurred in 25.78% of prescriptions, lower than Nepal (80.8%) and India (100%) (R. Shrestha & Prajapati, 2019). However, the omission of prescriber names dropped significantly from 100% in earlier studies to 0.20% in current studies. Polypharmacy remains prevalent, with higher rates in females (35.76%) compared to males (28.14%) and in private chambers (71.53%) versus private hospitals (48.98%) and government hospitals (17.67%). This aligns with previous findings where private hospitals showed twice the polypharmacy rate of government hospitals (24.15% vs. 12.5%) (Ofori-Asenso et al., n.d.). Older adults (>65 years) had the highest polypharmacy rate (53.52%), while children (<13 years) had the lowest (23.17%). Similarly, drug-drug interactions were more common in females (27.25%) than males (23.24%), though these rates were lower than in previous reports (42% vs. 45%). The highest interaction rate was among those aged >65 (42.25%), though another study reported a higher peak among those aged 60–69 (50%) (Teka et al., 2016). In JUMC, Ethiopia, most patients were male (52.5%) and over 56 years old, with a significant risk of drug-drug interactions (Diksis et al., 2019).

Ultimately, these findings highlight the urgent need for rational prescribing practices to mitigate adverse outcomes such as drug interactions, resistance, and dependency. There are a number of significant limitations to this study, which evaluates WHO drug use indicators, polypharmacy, prescription errors, and patterns of in Bangladesh. First, the cross-sectional design makes study more difficult to determine causal relationships between long-term results and observed prescribing behaviors. Since the data were gathered all at once, it was unable to evaluate changes in prescribing behavior over time. Second, the study only included a limited sample size, which might not be representative of the larger population and could restrict how broadly the results can be applied. Furthermore, the geographic coverage was limited to specific locations, which might not accurately represent prescribing and drug usage patterns across the country. This restriction might lead to regional inequalities, which would further limit the findings' all over application. Furthermore, the study only looked at outpatient settings, thus it didn't include data from inpatient departments, where medication use patterns and error rates differ significantly. The analysis's thoroughness gets hampered by the absence of inpatient data, especially when it comes to comprehending the full range of errors in prescriptions and polypharmacy in the healthcare section. In order to give a more thorough and comprehensive assessment of drug pattern in Bangladesh, such limitations highlight the significance of future research employing prospective study designs, with a wider population representation, and combining both inpatient and outpatient data. A number of important applications can be put into place to enhance drug use habits in Bangladesh based on the study's findings and in compliance with current recommendations. First, in order to address irrational prescription and lower errors in medication, it is essential to raise awareness and provide continuing professional education for healthcare providers. Evidence-based prescribing can be promoted and understanding of WHO drug use indicators can be improved by structured training delivered through workshops, seminars, and inclusion into medical education. Second, there is a need to strong policy and regulatory frameworks by developing and enforcing standardized prescribing guidelines with international best practices. Regular prescription audits, feedback, and national monitoring systems can support policy implementation and ensure accountability. Third, establishing focused training programs for pharmacists and prescribers will significantly improve their ability to manage polypharmacy and identify prescription errors, particularly in outpatient treatment. Lastly, patient-centered care plans, thorough medication evaluations, and shared decision-making can all be facilitated by promoting interprofessional collaboration between doctors, pharmacists, and other healthcare system. Together, these applications provide a strategic approach to enhancing drug safety, promoting rational drug use, and overall quality of healthcare delivery in Bangladesh.

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