

## Drug Utilization Pattern in Geriatric Inpatients of a Tertiary Care Teaching Hospital in Northeast India

Himadri Sekhar Dasgupta<sup>1</sup>, Julie Wahlang<sup>2</sup>, Nikhil Era<sup>3</sup>, Chayna Sarkar<sup>4</sup>

<sup>1</sup>Mata Gujri Memorial Medical College, Kishanganj

<sup>2</sup> NEIGRIHMS, Shillong

<sup>3</sup>Mata Gujri Memorial Medical College, Kishanganj

<sup>4</sup>NEIGRIHMS, Shillong

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Corresponding Author: Dr. Nikhil Era

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### Abstract:

**Background:** This study was conducted to assess the drug utilization pattern among geriatric inpatients of medicine wards at a tertiary care teaching hospital. The geriatric population is the subject of rare research studies on drug utilization patterns.

**Objectives:** The present study aimed to investigate the drug utilization pattern and prevalence of polypharmacy, and potentially inappropriate medicines in elderly people (over 60 years) in North East India.

**Methods:** A prospective observational study was conducted for all cases of elderly patients (age more than 60 years) admitted to the medical wards of NEIGRIHMS, Shillong, in the past 1 year. Demographics, various system involved, diseases diagnosed, comorbidity patterns, commonly prescribed medications, polypharmacy evaluation, drug administration method, and WHO core prescribing indicators were analyzed.

**Results:** A total of 156 prescriptions of geriatric patients admitted in inpatient department were randomly selected and all the required data for the study were collected and evaluated. The majority of patients were found to be in the age group of 66-70 years (30.8%). It was noticed that males (64.1%) were more compared to females (35.9%). The drugs prescribed were analysed. Pantoprazole, Ceftriaxone, Amlodipine, Tramadol, Insulin, Paracetamol, Furosemide, and Ondansetron were more commonly prescribed. Peptic ulcers (65.38 %) were identified as the commonly diagnosed disease followed by bacterial infection (46.70%)

**Conclusion:** This study reveals the medicine consumption patterns of the elderly patients in the tertiary care hospital as well as other frequent ailments that affect them. When it comes to prescriptions for the elderly, polypharmacy and unreasonable medicine use contribute to problems.

**Keywords:** Geriatric, drug utilization pattern, inappropriate, polypharmacy, prevalence, inpatients.

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### Introduction

The geriatric population is increasing daily in every nation, making the aged population a top research concern worldwide. In the Indian context, the similar trend is anticipated to persist, with projections indicating that it will rise from 5.6% in 1961 to 12.4% by 2026 [1]. India has not only seen a significant increase in the number of elderly people, but also in life expectancy during the past century. An Indian adult's life expectancy was barely 32 years in the early 1930s. Currently, India's life expectancy is roughly 67 years, which is lower than the 75-year global average. By 2025, the average lifespan in India is anticipated to be 75 years. Furthermore, according to UN estimates, the proportion of elderly Indians would increase to 21.2% of the overall population by 2050 (from an anticipated 7.2% in 2005) accounting to 324 million [2]. One of India's healthcare system's

greatest accomplishments may be the rise in life expectancy. Additionally, it creates a significant public health problem. Drug-related issues including drug-drug interaction have grown in number along with the ageing population. Age-related disorders, a rise in the likelihood of hospital admission, longer hospital stays, and more involved medication regimens all contribute to the rising population's health care needs [3]. An estimated 50% of older persons in India have at least one chronic illness that necessitates lifetime treatment. [4] Elderly persons are the most important medicated group of patients and are prescribed the highest proportion of medications [5,6] making them susceptible to develop diseases. While longer life expectancy indicates better overall health, it also presents problems because of the sharp growth in a number of chronic and non-communicable

diseases. A record number of older adults are using drugs, and many of them are taking three or more prescription medications at once. The frequency of comorbidities is one of the likely reasons for the significant number of medications [7]. These pharmacological issues can be overcome by optimizing prescribing patterns and developing prescription recommendations for senior patients, as well as by regularly assessing drug utilization. With an emphasis on the social, medical, and economic repercussions for a community, drug use research is a useful instrument for evaluating drug use [8]. There are relatively few research on the use of drugs in elderly people, particularly in North Eastern India [9]. The main objective of the present investigation was to explore the drug use patterns, socioeconomic traits, patterns of morbidity, and comorbidities among senior patients in North-East India.

### Materials and Methods

This study evaluates the use of drugs in elderly patients in medicine wards of a North East Indian tertiary care teaching hospital.

**Ethical issues:** The study was approved by the Institutional Ethics Committee (IEC) and participants provided their informed consent in their native language.

**Study pattern and location:** The study, a 12-month observational, prospective, observational, hospital-based study, surveyed patients aged 60 and older admitted to a tertiary care hospital at North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences.

**Choice of samples:** Calculated sample size is 156 patients at a minimum with a 10% margin of error.

**Inclusion criteria:** Patients aged 60 or older, were admitted to the General Medicine Department's ward and given informed consent to participate in the study.

**Exclusion criteria:** Patients who couldn't give consent, were critically ill, used ventilators, or were mentally unstable were excluded.

**Data collection method:** Patient information was collected daily into a pre-structured excel case record form when patients were being followed up during clinical rounds.

**Data Analysis:** The study analyzed data on elderly patients' prescriptions using an Excel spread sheet, focusing on factors like demographics, polypharmacy, disease prevalence, drug classes, and fixed-dose combinations.

### Results

The study analysed 156 prescriptions for patients over 60 years age in the inpatient medicine department, resulting in 870 formulations, with an average of 5.6 medications per prescription, and

assessed the data based on age and gender (Table 1 & Table 4).

**Socio-demographic profile:** Of the 156 patients, there were more male patients (64.1%) than female patients (35.9%). 30.83 percent of the patients were between the ages of 66 and 70. The majority of patients (57, or 36.54%) had a graduate degree, and 56, or 35.90%, had less than a 10th grade education (Table 1). Majority of the patients were admitted for a duration of 2–5 days (40%) followed by hospital stay of 5–10 days (28%) [Fig.3].

**Patients' trend towards system disorders:** Alimentary tract disorder (ATD) was the most common condition among the study population (76.28%), followed by infectious diseases (50.0%), cardiovascular disorders (44.87%), and endocrinological disorders (33.33%) (Table 2).

**Diagnosed diseases or disorders:** Gastro-oesophageal reflux disease and peptic ulcers (65.38%) were identified as the commonly diagnosed disease in the study population (Table 2 and Fig. 1) followed by bacterial infection (46.70%), hypertension (24.36%), congestive heart failure (20.51%), bronchial asthma (19.87%), diabetes (19.23%), anaemia (16.66%), partial seizure (14.74%) and psychotic disorder (14.10%). Less incidence of disorders or diseases were found for renal and genito-urinary diseases and liver cirrhosis (Table 2)

**Comorbidity trend:** The data revealed that 47.44% of patients had two comorbid conditions, with GERD being the most common (65%), followed by chronic diseases like obstructive pulmonary disease, diabetes, thyroid and epilepsy (Fig1 & Fig2).

**Prescription indicators analysis:** The average number of drugs prescribed per prescription was 5.58. The minimum and maximum number of drugs prescribed for a single patient was 2 and 14, respectively. Percentage of drugs prescribed by generic name was 74.7%. 33.9% of interactions involved antibiotics, while 79.4% of prescriptions were for injectables. 88.2% of drugs were included in the WHO Essential Medicines List (WHO-EML) and 87.1% of drugs were listed in NLEM (Table 3).

**Commonly prescribed medications:** A total of 870 drug formulations were prescribed to the study population (Table 4). Of all the medications supplied to patients, pantoprazole in injection form (65.16%) and tablet form (8.97%) accounted for 73.71% of all prescriptions (Table 4).

Ceftriaxone (40.38%) was the most prescribed antibiotic in the population. In the case of hypertension, the most commonly prescribed medications were Amlodipine, accounting for 14.1%, and Telmisartan, which represented 10.32% of prescriptions (refer to Table 5). Insulin, with a frequency of 21.15%, ranked third among the

medications used, while Pantoprazole and Ceftriaxone held the top two positions in terms of frequency (see Table 5). In the studied population, Thyroxine sodium (14.10%) was the most utilized treatment for underactive thyroid.

For respiratory conditions such as asthma and chronic obstructive pulmonary disease (COPD), nebulization with Budesonide (11.54%) and Formoterol were frequently administered to the patients who were admitted.

**Polypharmacy:** The average number of medications prescribed per prescription did not show a significant difference between male and female participants, with averages of  $5.48 \pm 1.05$  for men and  $5.51 \pm 1.09$  for women. In total, 32.7% of the participants received fewer than five medications, while 67.3% were prescribed more

than five. A statistically significant positive correlation ( $r[p] 0.380 [0.001]$ ) was identified between the presence of multiple chronic conditions and the occurrence of polypharmacy.

**Assessment of PIM:** All prescriptions and medications were scanned, and medications recommended by other doctors were also taken into consideration. Beer's criteria 2019 [36] was used to identify PIM, which was then divided into different categories: medications to be avoided, drugs to be used cautiously, and drugs to be used with caution, drugs to be avoided depending on kidney function. Beers' criteria revealed that 331 medications (38.05%) out of all prescriptions were recorded, there were almost (2.12) PIMs per prescription (Table 4 and Table 6).

**Table 1: Demographic characteristics of patients**

Characteristics	Number	Frequency (%)
<b>Number of patients enrolled in the study (n=156)</b>		
<b>Gender</b>		
Male	100	64.1
Female	56	35.9
<b>Literacy</b>		
Illiterate	Nil	
< 10 <sup>th</sup>	56	35.9
10 <sup>th</sup>	29	18.59
12 <sup>th</sup>	14	8.97
Graduate	57	36.74
<b>Age (in years)</b>		
60-65	28	17.4
66-70	37	23.71
71-75	13	8.33
76-80	15	9.62
81-85	2	1.28
>85	4	2.56

**Table 2: Clinical causes for admission of patients**

Diseases/disorder (ATC classification system, 2021) [6]	Number of patients	Frequency (%)
Alimentary Tract and metabolism disorder	119	76.28
A) Gastro-oesophageal reflux and peptic ulcer	102	65.38
B) Liver Cirrhosis	11	7.05
Blood and blood forming organs disorder	30	19.23
A) Anaemia	26	16.66
Cardiovascular system disorder	70	44.87
A) Congestive heart Failure	32	20.51
B) Hypertension	38	24.36
Renal and Genito-urinary diseases	18	11.54
Endocrinological disorders	52	33.33
A) Diabetes Mellitus	30	19.23
B) Hypothyroidism	22	14.1
Nervous System disorder	30	19.23
A) Partial seizure	23	14.74
Respiratory system disorder	42	26.92
A) Bronchial Asthma	31	19.87
B) COPD	11	7.05
Infectious Diseases	78	50
A) Amoebic dysentery	6	4
CNS disorders	22	14.1

**Table 3: The WHO core prescribing indicators**

WHO core indicators	Frequency (%)
Average number of medications per prescription	5.58
Encounters having injectable preparations	79.49
Encounters having antibiotic prescribed	33.97
Medications prescribed by generic name	74.71
Medications prescribed by included in essential drug list	88.28
Drugs prescribed as FDC	19.08

WHO: World Health Organization; FDC: Fixed-dose combination

**Table 4: General characteristics of prescription and PIM in geriatric population**

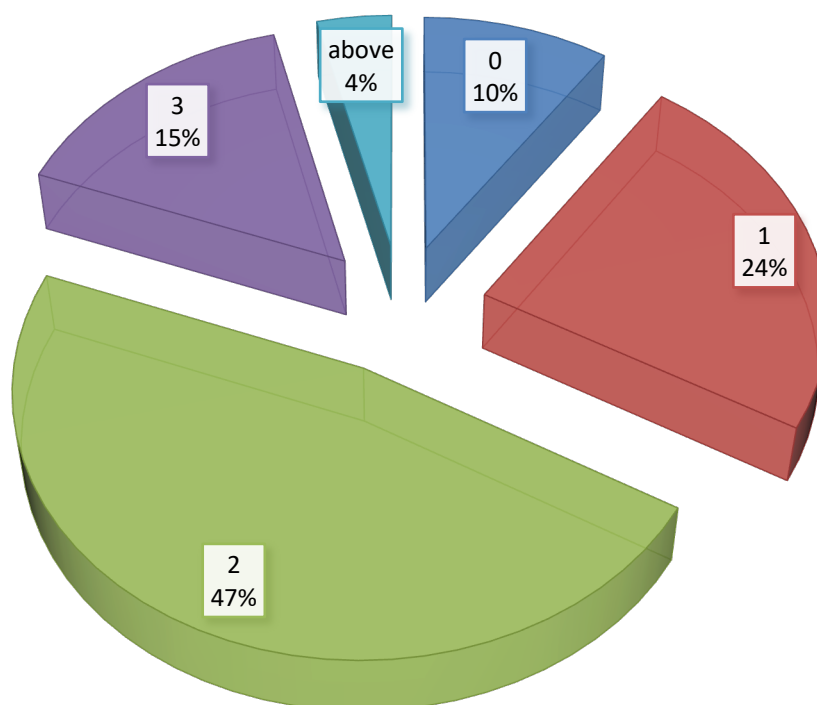
Sl. No.		Number
1	Total Prescription	156
2	Total drugs	870
3	Average prescription of drugs	5.6
4	Potential Inappropriate Medicine (PIM)	331
5	PIM per prescription	2.12
6	Suspected Adverse Drug Reaction	11

**Table 5: Most frequently prescribed medications (n=156)**

Sl. No.	Medication name	Number of prescriptions	Frequency (%)
1	Pantoprazole	115	73.72
2	Ceftriaxone	63	40.38
3	Ondansetron	35	22.44
4	Insulin	33	19.23
5	Paracetamol	30	18.59
6	Furosemide	29	15.38
7	Azithromycin	23	14.74
8	Amlodipine	22	14.19
9	Thyroxine sodium	22	14.19
10	Ferrous Ascorbate & Folic Acid	21	14.10
11	Piperacillin-tazobactam	19	13.46
12	Nebu Budesonide and formoterol	18	12.18
13	Sod. Bicarbonate	17	11.54
14	Telmisartan	16	10.90
15	Cilnidipine	16	10.26
16	Atorvastatin	16	10.26
17	Prazosin hydrochloride	15	10.26
18	Hydrocortisone	15	10.26
19	Potassium salt	13	8.33
20	Tramadol	13	8.33

**Table 6: Potentially inappropriate medications for use in older adults following Beer's criteria, 2019 [36]**

Medication Class	Name of drugs	Severity rating	Frequency (number of patients and percentage)	P value
<b>A) Potentially Inappropriate medications</b>				
1. Anti-infective	Nitrofurantoin	Low but to be avoided	6 (3.8%)	<0.0138
2. Alpha-1 blocker Agents	a. Prazosin	Moderate (Avoid)	15 (9.62%)	<0.0001
	b. Clonidine for first-line treatment of hypertension	Low (Avoid)	2 (1.28%)	0.1580
3. CNS Active drugs	a. Lorazepam	Moderate (Avoid)	4 (2.54%)	0.0611
	b. Levetiracetam	Avoid	7 (4.48%)	<0.0043
	c. Zolpidem	Moderate (Avoid)	2 (1.28%)	0.1580
	d. Quetiapine	Moderate (Avoid)	12 (7.69%)	<0.0004
4. Endocrine	Insulin	Moderate (Avoid scheduled use for >8 weeks)	33 (21.15%)	<0.0000
5. Proton pump inhibitors	Pantoprazole	High	115 (73.71%)	<0.0000
6. Non-Steroidal Anti-inflammatory Agents (NSAIDs)	a. Aspirin	Moderate (Avoid Chronic use)	9 (5.76%)	0.0002
	c. Paracetamol		30 (19.23%)	<0.0000
<b>B) Drugs to be used with caution</b>				
1. Diuretics	a. Furosemide	Moderate (Use with caution)	29 (18.58%)	<0.0000
	b. Torsemide		7 (4.48%)	0.0043
	c. Spironolactone		1 (0.006%)	0.3189
2. CNS Active drugs	Tramadol	Moderate	13 (8.33%)	<0.0002
3. Antiplatelet Drugs	Aspirin- clopidogrel	Moderate	9 (3.51%)	<0.0024

**Figure 1: Number of associated comorbid pattern in the study population**

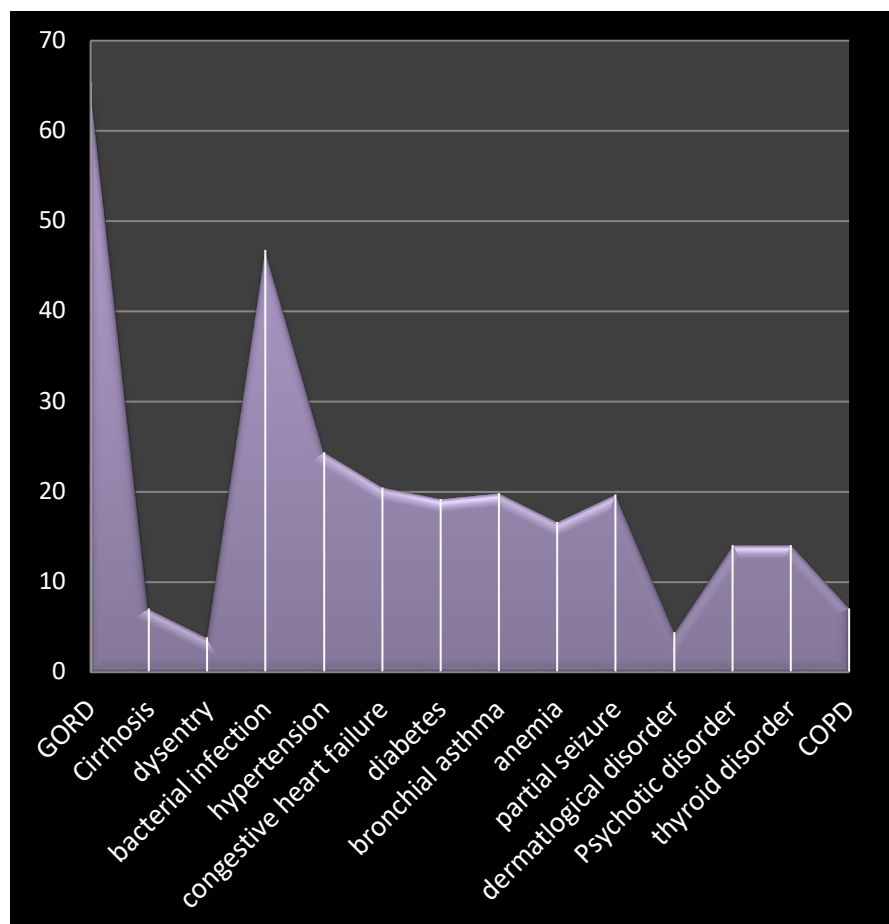


Figure 2: Frequency (%) of different diseases among the admitted patients

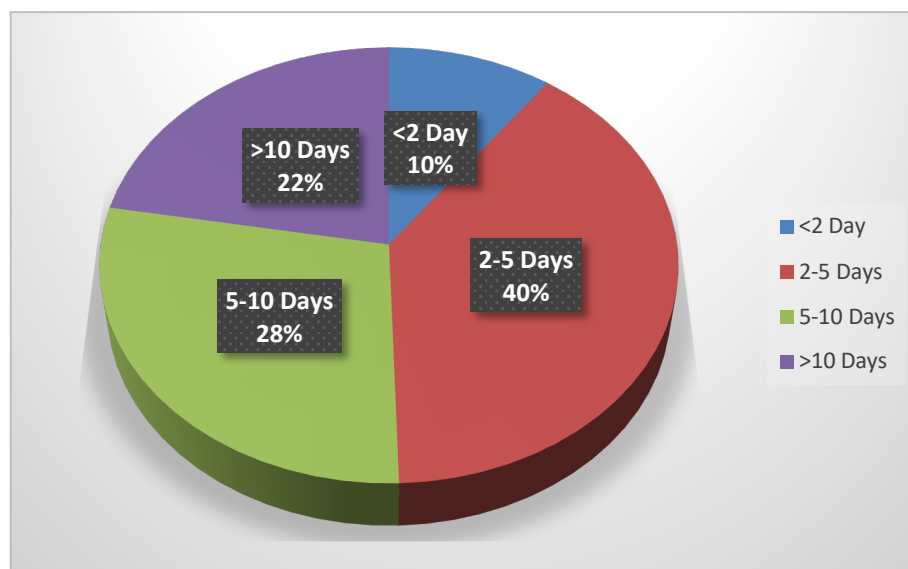


Figure 3: Average Duration of hospital stay

### Discussion

This study aimed to analyse the patterns of drug utilization among elderly patients undergoing poly-pharmacy regimens in Shillong, Meghalaya, while also assessing the occurrence of adverse drug reactions. Additionally, the research highlighted the interplay of various factors, such as demographic

characteristics, literacy levels, and health-related issues, influencing poly-pharmacy within the admitted population at NEIGRIHMS, Shillong.

In the present investigation, data from 156 patients were analysed, revealing a gender composition of 64% male and 36% female. This gender distribution aligns with findings from previous

studies conducted by Shah et al. [11], Nayaka et al. [12], Binod et al. [13], Kolha et al. [14], and Borah et al. [10], all of which reported a predominance of male patients. The largest age group among the patients was those aged 66 to 70, accounting for 31%, while the smallest group, comprising only 1.28%, was aged between 81 and 85. This pattern is consistent with earlier research focused on elderly patients in India. Conversely, a similar study carried out in South India indicated a majority of female participants [12].

According to a literacy analysis of the population under investigation, all of the patients had completed at least grade V or VI and a significant portion of them (37%) were graduates, which was higher than the previous report by Borah et al.

**Potentially Inappropriate Medications:** Elderly patients experience ADRs more frequently for a variety of reasons, including the use of PIMs. PIMs are given to elderly patients both in an outpatient environment and while they are in the hospital. PIM use is thought to be responsible for about one-fourth of the negative outcomes in elderly people [39]. Beer's criteria, a total of 53 medications or medication classes are divided into three groups: potentially inappropriate medications and classes that should be avoided, in the elderly with specific diseases and syndromes that the drugs may exacerbate, and medications that should be used cautiously [40]. The current investigation showed an increasing prevalence of high-severity PIM use, which is consistent with findings from other studies [40]. In the present study GERD was identified as one of the most important predictors of PIM use and proton pump inhibitor, a member of PIM was frequently used to control GERD. High PPI usage is consistent with other findings [38] due to its relative superior efficacy and good safety compared to H2 receptor blockers, PPI overuse is an issue around the world [38]. They should not be used for longer than 8 weeks though, as they have been linked to bone loss and fracture as well as Clostridium difficile infection [15]. It's important to educate patients and healthcare professionals about the long-term negative effects of PPIs, particularly given the low awareness of improper PPI usage and the associated adverse events among patients and healthcare professionals including doctors, pharmacists, and nurses. By distributing the list of medications that should always be avoided along with possible substitutes, checking the prescriptions, and conducting educational sessions, the use of inappropriate pharmaceuticals was dramatically reduced in one Italian study [37]. Similarly, how hypertension can be controlled with low use of PIM is also another concern as presence of hypertension was disclosed as one of the predictors for PIM use in the present study. Periodic evaluations must alert clinicians to

possible inappropriate drug use in geriatric patients. Where there are no dedicated geriatric clinics, hospital-specific prescribing guidelines can be developed for elderly patients. [38]

**Morbidity pattern and polypharmacy:** The current study's morbidity trend related to the damaged organ system was comparable to earlier findings from studies carried out in different regions of India [15]. In the current investigation, comorbid conditions were present in almost 90% of the participants. Two comorbid conditions were present in 47% of hospitalized patients, one in 24%, and three in 13%. However, Jyotsna et al. [15] and Sharma et al. [16] found that 38% and 66% of the elderly study participants, respectively, had three and one comorbid condition. The functional loss associated with organ system ageing is most likely the reason of aged people's susceptibility to a variety of diseases. Compared to a similar study on elderly people in India where the average was 7.3, the average number of drugs per prescription was 5.6. Our results are in line with a prior study by Borah et al. [10] that found an average of 5.6 medications per prescription. However, Weiss et al. [17] and Shenoy et al. [18] found that the average was 5. Shah et al. [11] prescribed up to 27 medications, but the current study only allowed a patient to get 15 medications. 115 participants (74%) in the current study were prescribed five or more medications.

Similar findings were reported by Borah et al. [10], who found 78% polypharmacy. In comparison, 16.5% of patients in Pondicherry experienced polypharmacy [19]. In this study, there was a substantial positive connection between polypharmacy and comorbidity. This is to be expected, given that comorbidities explain polypharmacy. Polypharmacy frequently leads to a rise in ADRs, a drug interaction prescription cascade, and a reduction in quality of life, mobility, and cognition [20]. Polypharmacy has been recorded in numerous developed countries throughout the world. The more medications administered concurrently, the greater the chance of side effects, drug interactions, and prescription mistakes [21]. As we get older, we become more vulnerable to disease and more likely to develop various and chronic diseases.

Many polypharmacy situations are due to a lack of regular assessment of the therapeutic regime by health experts, as well as rigorous adherence to recommendations, which often leads in prescription a high number of drugs. [22] Polypharmacy predisposes the elderly to prescribe potentially inappropriate medications (PID), indicating that the actual harms of the therapy outweigh the benefits. Experience, technical skill, conversation with patients, motivation to reassess treatment, and a supportive attitude towards non-prescription can all

limit PID [23]. The identification and reduction of improper drug dosages should be prioritised for patient safety [23]. Polypills, which are pills containing a combination of the pharmaceuticals used by patients, are an alternative to polypharmacy for facilitating treatment, reducing errors, and saving time. However, the safety, efficacy, and firmness of each pill's dosage must be carefully evaluated [24].

**Drug utilization pattern:** Alimentary Tract Disorder was found to represent a major category of sickness in the current investigation. Alimentary Tract Disorder (ATD) is well documented to impact a huge number of individuals worldwide (about 60 to 70 million people in the US each year) and contribute significantly to morbidity and death in the United States, Finland, Italy, and many other countries [25-27]. Research in Finland found that gastrointestinal tract and metabolism category medications were prescribed to 77% and 42% of senior patients on polypharmacy regimens in Finland and Italy, respectively [27-28]. As a result of the widespread occurrence of ATDs around the world, there has been an increase in the use of alimentary tract and metabolism medications.

The most frequently prescribed sub-classes in the alimentary tract category were: A02: drugs for acid-related disorders (64.5%), and A03: drugs for functional disorders.

These medicines are generally safe and effective in treating gastric ulcers, heartburn, and gastro-oesophageal reflux disease (GORD). Proton pump inhibitors (PPIs) are the best-selling medications in their category around the world. Proton pump inhibitors are widely used to treat gastrointestinal diseases in addition to gastritis. In the current study, the majority of the patients were given anti-ulcer medications. Pantoprazole was the most usually given antiulcer medicine (74%). Similar findings were observed by Razavi et al [8], Shah et al [11], and Gupta et al [29] who previously identified Pantoprazole to be the primary medicine (>23%) for peptic ulcers disease and acute gastritis. In contrast, Rantidine was the most often given medicine, according to Jyotsna et al [14] (13.3%), Shah et al [11], and Zaveri et al [30]. Rantidine is often used as a prophylactic medication [15]. The highest use of GIT medications was seen in the 65-70 age group [31]. Long-term use of proton pump inhibitors (PPIs) has been associated with a variety of symptoms, which encompass osteoporosis, hip fractures, an increased susceptibility to infections, hypergastrinemia, inadequate absorption of vitamins and minerals, renal dysfunction, and dementia [29]. To avoid associated side effects and costs, healthcare practitioners must follow prescribing standards and limit their usage of PPIs.

The second most often recommended medications in this study were anti-infectives for systemic use. Ceftriaxone was found to be the most commonly used antibiotic in the current study, with more than one-third (73/156) of patients receiving it as their first choice. Razavi et al. [8] also reported that more than 30% of patients received antibiotics. While Nitya et al. [32] identified Amoxicillin as the most widely used antimicrobial, the percentage of encounters with an anti-biotic prescribed medicine was 9.7%, which was significantly lower than the current finding. Jyothsna et al [15] also reported a low percentage of antibiotic exposures. In general, antibiotics were recommended to treat primary or secondary infections, as well as to avoid nosocomial infections. Antibiotic overuse leads to antimicrobial resistance, thus wise considerations should be made when administering antibiotics. Cardiovascular disease medications were the third most commonly administered in the current study. These data support the notion that cardiovascular illnesses (CVDs) are the most common and leading causes of death worldwide, accounting for 17.3 million deaths in 2013 [33].

According to a Danish survey, cardiovascular medications (35%) were the most commonly prescribed class for elderly people over the age of 70 [34]. But Bora et al. [10] reported a lower prescription of cardiovascular drugs (25.7%). In the current study, the most generally recommended medicines for the treatment of CVS disorders including hypertension and heart difficulties were furosemide (18.59%), amlodipine (14.19%), telmisartan (10.26%), and atorvastatin (10.26%). The mildest interactions involved furosemide and amlodipine interactions. When ACE inhibitors were used in conjunction with loop diuretics, severe postural hypotension was observed.

The fourth most prescribed medications were for endocrine or hormonal system problems, specifically diabetes and hypothyroidism. Insulin (21.2%) was the most used drug for diabetes, followed by thyroxine sodium (14.10%) for hypothyroidism. Inhalation therapy with budesonide and formoterol (11.5%) and salbutamol (17.5%) was commonly administered for COPD and asthma. Razhavi et al [8] found that prescribed medications for COPD and asthma were more common than the current data, with 25.9% for nebulization budesonide and 17.5% for salbutamol. Tramadol was the most frequently recommended drug for various conditions in the current study (40%) followed by paracetamol (19.2%) as an antipyretic analgesic, a drug used to temporarily treat mild-to-moderate pain and fever. Razavi et al. [8] discovered a high use of analgesics, indicating that the elderly have a significant desire to treat or eliminate acute discomfort. Similarly, ferrous ascorbate and folic acid were commonly



prescribed.127 (13.5%) to treat anaemia and iron deficient disorders.

In summary, the most commonly prescribed active substances in the current study were Pantoprazole, Tramadol, Insulin, Paracetamol, Furosemide, Ondansetron, Azithromycin, Amlodipine, Ceftriaxone, Thyroxine sodium, Ferrous ascorbate, and Folic acid, with a frequency of more than 13%.

### Conclusion

Older patients often receive multiple pharmacological classes for various disorders, with comorbidity and polypharmacy being correlated. PIM use increases with high polypharmacy, particularly for GERD and hypertension. However, risk associated with PIM use is often overlooked in clinical practice, necessitating further studies to evaluate justification and advice.

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