ASSESSMENT OF PRESCRIBING PATTERN OF DRUGS IN GERIATRIC PATIENTS USING BEERS CRITERIA

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Abstract:

The global demographic trend conveys dynamic growth of population ageing. This inwardly shed the light on the high consumerism of medications of elderly as well as increasing risk of polypharmacy. The main objective of this study was to assess the prescribing patterns of geriatric patients in a tertiary care teaching hospital using the modified American Geriatric Society (AGS) updated beers criteria 2019.The prospective observational study was carried out in 330 patients in a period between September 2019 to March 2020 in a tertiary care teaching hospital. All patients from an age group above 60 years old in general medicine department were included. The study data was analyzed by using Microsoft Excel and Chi-square test using SPSS (Version 32).Among the enrolled 330 patients , the most commonly used inappropriate drugs was Pantoprazole 210(63.64%), Aspirin 82(24.85%) and Insulin 66 (20%). Majority of the patients were diagnosed with Hypertension, Diabetes, COPD and IHD. According to the criteria, most of the inappropriate prescriptions belong to the patients with the age group of 60- 70 years of male gender. This study accomplished with a conclusion that the inappropriateness of medication is directly proportional to the number of medications. The inappropriate medication prescription is prevalent in the older patients according to the Beers Criteria. Frequent assessment of prescription can help in improving thelife expectancy and quality of health in the geriatric patients.

Keywords: Beers Criteria 2019, Geriatric patients, Inappropriate, Prescribing pattern, Polypharmacy, Drug-Drug Interaction.

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INTRODUCTION:

According to Population Census 2011 of India, there are nearly 104 million elderly persons in India that holds 7.4% of total population and estimated rise to 12.4% by the year 2026[1]. It is observed in India, that the growth in elderly population has always been more than the growth in general population[1].As the rise of pandemic occurred recently, global focus turned to the declined health status and vulnerability of advanced age group patients in acquiring diseases. Inappropriate prescribing is highly prevalent in older people and has become a global healthcare concern because of its association with negative health outcomes including adverse drug events (ADEs), prolonged hospitalization and undesirable healthcare resource utilization [2]. Providing safe and effective drug therapy can be challenged by various factors such as acute and chronic disorders, reduced physiological reserves, age related alteration of pharmacokinetic and pharmacodynamic properties of a drug, cognitive changes with reduced medication adherence and organization etc. Polypharmacy, defined as the use of five or more drugs, is a significant public health problem, particularly in the older patients, since it is frequently responsible for the rise of morbidity and mortality[3].'The inappropriate prescription in older patients occurs when the risk of adverse effects exceeds the clinical benefits, especially when there are more effective alternatives available' [3].

The current literatures and recent publications emphasize more on the need of appropriate prescribing to avoid medication and economic burden as well as the need of promoting rational drug use in geriatric patients. Prescription pattern assessment elucidates the common prescribing errors and thereupon, helps prescribers as well as pharmacist to formulate various methods and measures for a better patient care.

There are several prescribing quality assessment tools for geriatric patients which are mainly categorized broadly as implicit, explicit and mixed criteria [3]. Implicit criteria (judgment-based) like Medication Appropriateness index (MAI), consider the patient's therapeutic regimen, patient specific as well as it is a time consuming whereas, explicit criteria (criterion- based) are list of drugs developed from literature reviews, consensus techniques and expert opinions [4, 5]. The mixed tools like Australian prescribing indicators tool uses prescribing indicators as well as patient specific information, showing a combination of both implicit and explicit approaches.

The 2019 AGS Beers Criteria® is an assessment tool that contains 30 individual criteria with medication or class of drugs to be avoided and 16 criteria specific to more than 40 medications or class of drugs that should be used with caution or avoided in certain diseases or conditions [8]. It contains ten tables including table showing designations of quality of evidence and strength of recommendations, PIM use in older adults, drug – disease or drug- syndrome interactions that may exacerbate the disease or syndrome, drugs to be used with caution in older adults, potentially clinically important drug-drug interactions that should be avoided in older adults, PIMs based on kidney function [6].A prospective observational study conducted by PAVANI GOLLAon "prescribing pattern of medications in geriatric patients in a south indian tertiary care teaching hospital". Among these patients 61 (58.65%) patients were in the age group of 60-65 years, 25(24.03%) was in 66-70 years, 12 (11.53%) were in 71-75 years, 6 (5.76%) were >75 years. The main cause for hospital admission was hypertension and diabetes. As per Beer's criteria, 91.3% drugs prescribed to the given study patients were found to be inappropriate. Antibiotics and Pantoprazole were the most commonly prescribed drugs. The study findings suggest that use of polypharmacy is high and majority of the medications prescribed were found inappropriate as per the Beer's criteria [7].

THE 2019 AGS BEERS CRITERIA®

The Beers criteria/Beers list was the first explicit criteria formulated in 1991 for assessing potentially inappropriate prescription in older people [8]. The American Geriatric Society Beers Criteria contains evidence based recommendation of potentially inappropriate medications that can be avoided in elderly patient prescriptions. The 2019 AGS Beers Criteria® is an interdisciplinary expert panel reviewed fifth update of every three year update by American Geriatric Society [9].

The 2019 AGS Beers Criteria® is an assessment tool that contains 30 individual criteria with medication or class of drugs to be avoided and 16 criteria specific to more than 40 medications or class of drugs that should be used with caution or avoided in certain diseases or conditions [9]. It contains ten tables including table showing designations of quality of evidence and strength of recommendations, PIM use in older adults, drug – disease or drug- syndrome interactions that may exacerbate the disease or syndrome, drugs to be used with caution in older adults, potentially clinically important drug-drug interactions that

should be avoided in older adults, PIMs based on kidney function [9].

This criterion is a valuable and relevant guideline to facilitate better medication therapy in older adults, thereby improving their health and well-being [9], which must be applied in beneficial way to the patient's pharmacotherapy and are not meant to be punitive.

The Global demographic trend conveys dynamic growth of population ageing. This inwardly shed the light on the high consumerism of medications of elderly as well as increasing risk of polypharmacy. The drug-drug interactions as well as adverse effects can have severe or less tolerated effect in elderly. Gerontologists have recognized medication associated problems that may lay huge disease burden over ELDERLY population. Making the clinicians as well as other health care professionals aware of the need for appropriate prescribing in older adults gives a hand to rational drug therapy in geriatric patients.

The Indian elderly population is growing and correct pharmacotherapy can be a challenge. As a first hand patient assess as well as a health care professional, Clinical Pharmacist plays a major role in providing geriatric assessment and intervention to reduce inappropriate medications and thereby improve quality of care as well quality of geriatric life. This study focuses on providing an assessment on prescribing pattern in older adults in South Indian state of Karnataka. Thus, to add geriatric prescribing information for better patient care.

OBJECTIVES:
➢ To assess the prescribing patterns in geriatric patients
➢ To assess the medication, use by Beer's criteria
➢ To analyze the Drug-Drug Interactions of the prescribed drugs
➢ To assess the frequency of polypharmacy in geriatric patients.

STUDY CRITERIA:
Study site
The study was conducted in selected community pharmacy in Mandaya district

Inclusion criteria
➢ All patients of age group above 60 years old of either gender was enrolled in medicine department,
➢ All patients of with or without co-morbidities & willing to participate in the study and ready to give the consent

Exclusion criteria
➢ All outpatients as well as those who are unwilling to participate in the study

SOURCE OF DATA:
Patient's demographic, clinical findings, laboratory and therapeutic data were collected from patients attending community pharmacy

METHOD OF DATA COLLECTION:
Prescription was collected from selected community pharmacy the study subjects were enrolled who meets the study criteria after getting consent form them. All the necessary details were documented in suitably designed data collection form.

The collected data was analyzed and evaluated using the AGS Beers criteria 2019 to detect potentially inappropriate medications and polypharmacy. Micromedex drug data base was used to check drug interactions and were evaluated and categorized into major, moderate and minor based on their severity.

IEC APPROVAL:
The study approved by Institutional Ethical Committee, AH&RC, B G Nagara, (AHRC No: AIMS/IEC/1462/2019-2020) Annexure No –1
Qualitative data was analyzed by frequency/percentage, mean, standard deviation and Chi-square test (p-value) using Microsoft excel and SPSS (Version-32)[9].
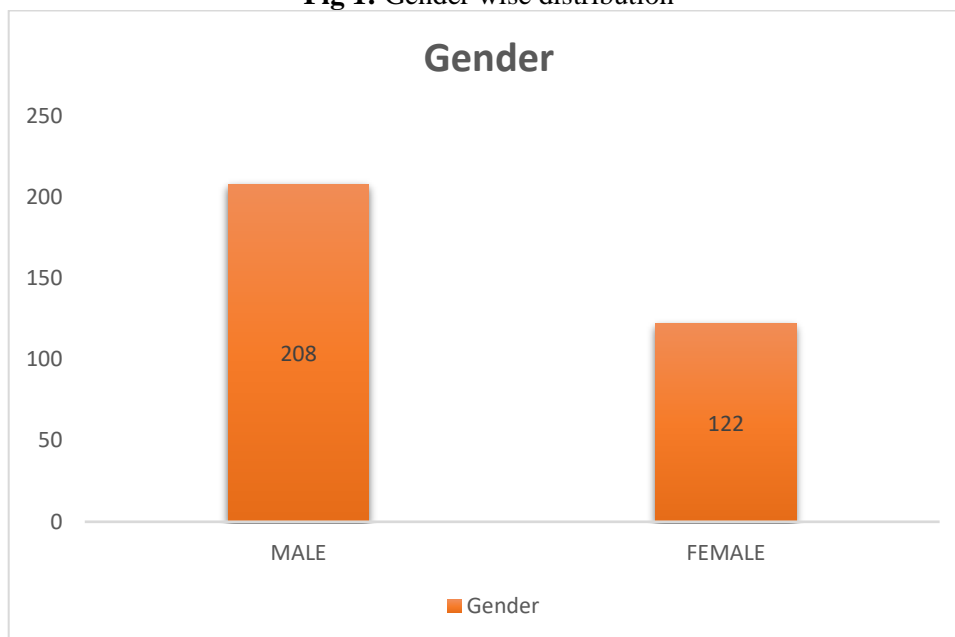
RESULTS:
1. PATIENT CHARACTERISTICS:
1.1 GENDER WISE DISTRIBUTION
In our study with sample size of 330 patients favoring inclusion criteria of both the gender, 208 (63.03%) were male and 122 (36.97%) were females.

Table 1: Gender wise distribution

| GENDER	TOTAL NUMBER OF STUDY SUBJECTS (n=330)	PERCENTAGE %
MALE	208	63.03%
FEMALE	122	36.97%

Fig 1: Gender wise distribution

1.2 AGE WISE DISTRIBUTION

Age wise distribution indicates that the majority of our study subjects were between the age group of 60-70 years (72.24%) which is then followed by the age group of 71-80(19.7%). The mean value age is 68.27 ± 7.11 standard deviation.

Table 2: Age wise distribution

| AGE GROUP	TOTAL(n=330)	PERCENTAGE%
60-70 YEARS	245	74.24%
71-80 YEARS	65	19.7%
81-90 YEARS	20	6.06%

Fig 2: Age wise distribution
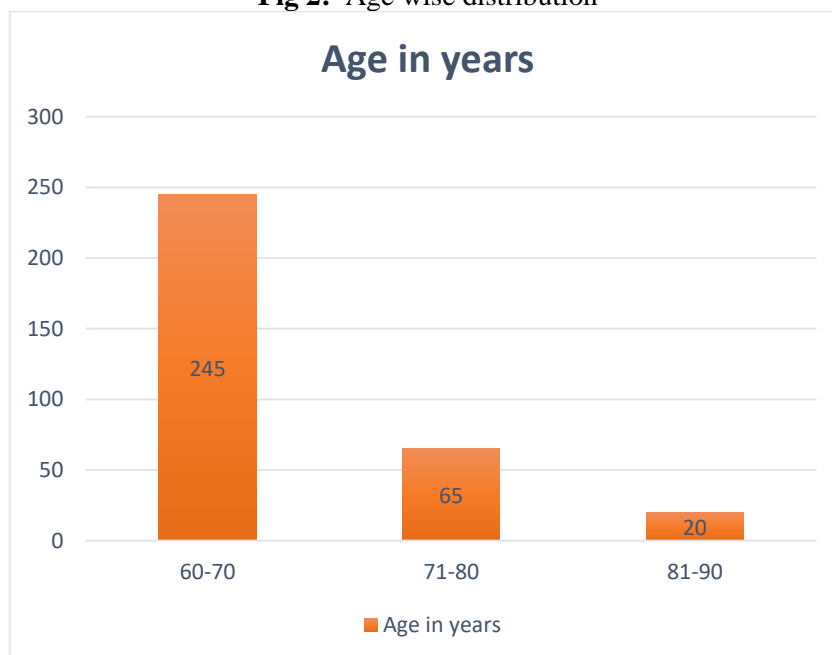
1.3 NUMBER OF DAYS OF HOSPITAL STAY

Out of 330 enrolled subjects, the number of patients discharged within 5 days of admission were found out to be 240 (72.72%) and the least number of patients 10 (3.03%) stayed for 10- 15 days for the treatment.

The mean value of number of days of hospital stay is 4.99± 2.54standard deviation.

Figure 1: Graphical representation of number of days of hospital stay of the enrolled patient
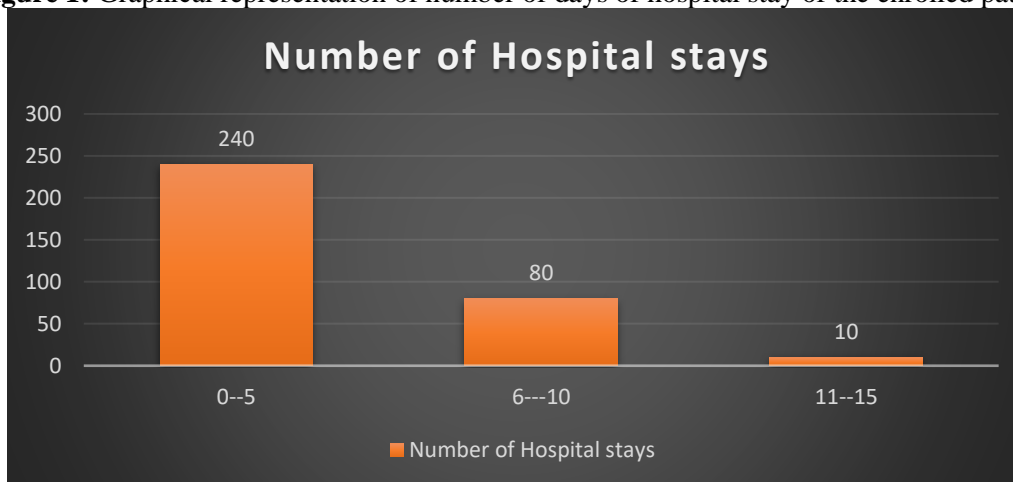

1.4 COMPLAINTS ON ADMISSION

The enrolled study subjects were identified with various kinds of chief complaints such as Respiratory complaints (39.7%) and constitutional complaints (29.4%) which was followed by neurological complaints (15.15%), Gastrointestinal complaints (8.8%), hemorrhagic (1.82%), rash (0.6%).

Table 4: Complaints on Admission

COMPLAINTS ON ADMISSION	FREQUENCY (n=330)	PERCENTAGE
Respiratory	131	39.7%
Gastrointestinal	29	8.8%
Rash	2	0.6%
Hemorrhagic	6	1.82%
Constitutional	97	29.4%
Neurological	50	15.15%
Other	15	4.53%

Figure 4: Graphical representation of complaints on admission of enrolled patients
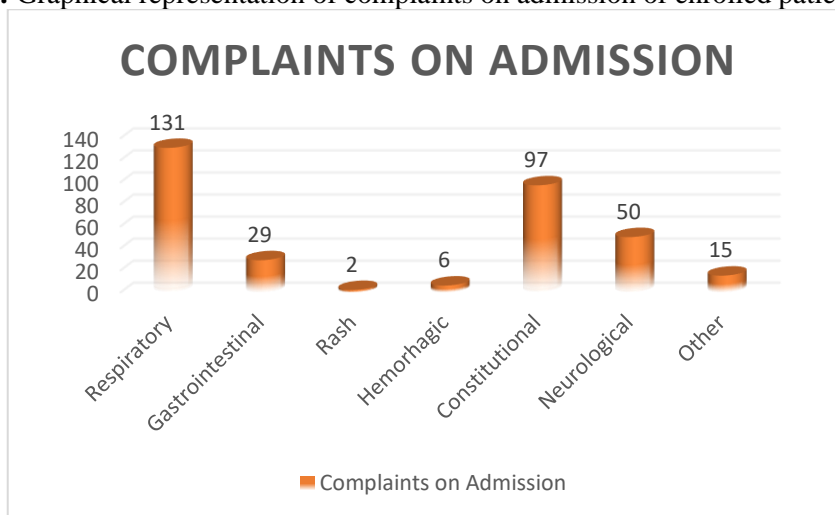
## 1.5 SPECIFIC VS NON-SPECIFIC COMPLAINTS

Specific versus non-specific complaints implicate that the majority of our study subjects 44.24% presented specific complaints (SC) whereas 55.76% presented non-specific complaints (NSC).

Table 5: Specific versus Non-specific complaints

UNKNOWN COMPLAINTS	FREQUENCY(n=330)	PERCENTAGE
Specific Complaints	146	44.24%
Non-Specific complaints	184	55.76%

**Fig 5:** Specific versus Non-specific complaints
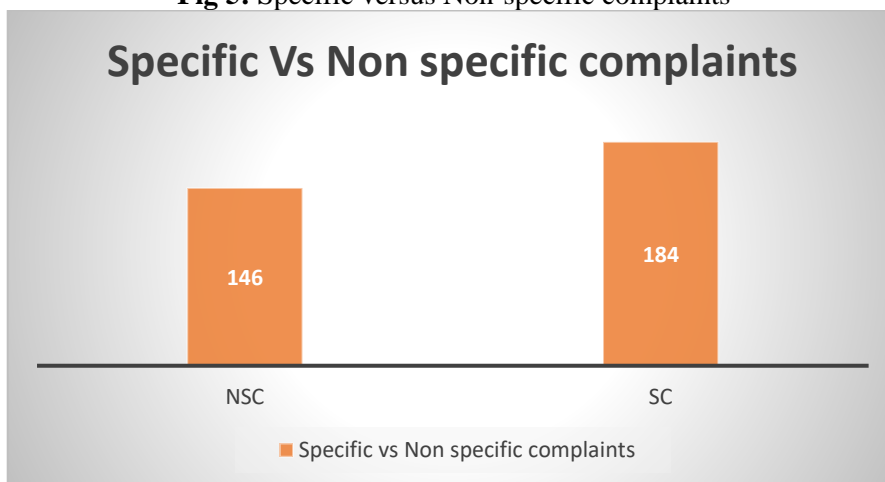
1.6 SOCIAL HISTORY

Assessing the enrolled patients for social history, it was identified that, out of 330 subjects, 280 (84.85%) had no record of social habits whereas 10(3.03%) were alcoholic, 29 (8.79%) were smokers and 11(3.33%) were both.

Table 6: Social History of the patients

SOCIAL HISTORY	FREQUENCY (n=330)	PERCENTAGE
No Habits	280	84.85%
Smoker	29	8.79%
Alcoholic	10	3.03%
Alcoholic + Smoker	11	3.33%

**Figure 6:** Graphical representation of social history of the enrolled patient
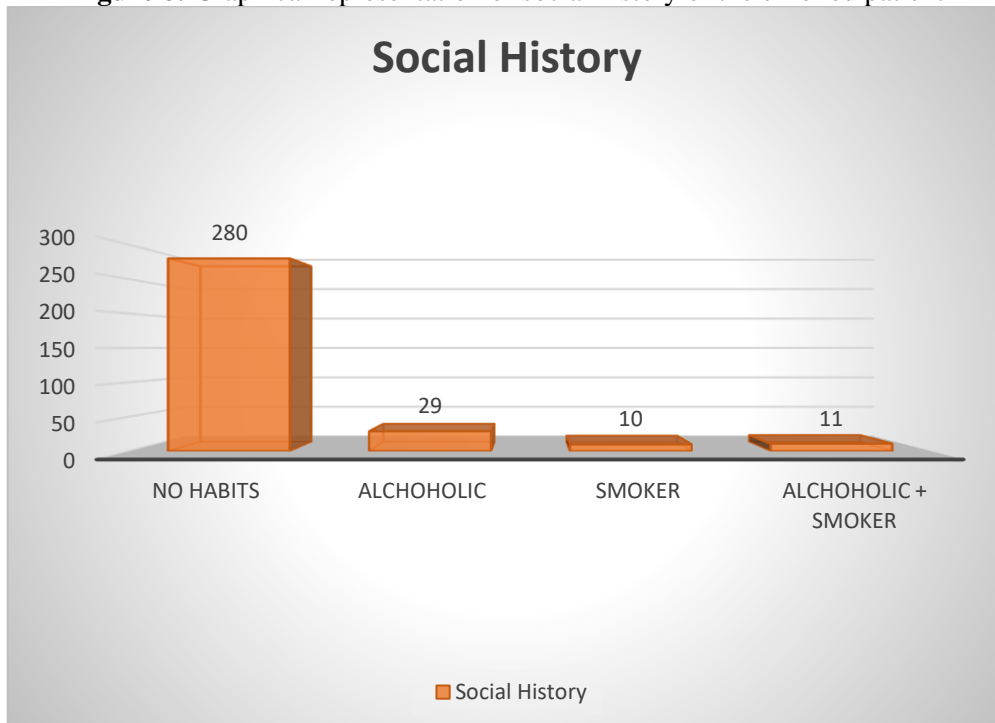
2. POLYPHARMACY DISTRIBUTION IN ELDERLY STUDY SUBJECTS

Among 330 study subjects, we found about 172(52.12%) polypharmacy prescriptions in which 32 prescriptions had major polypharmacy and 48 prescription had semi-major polypharmacy and 92 prescription had minor polypharmacy. The comorbidities, concomitant diseases and prolonged hospital stay can be the leading reason for multiple prescriptions. Also, it was observed that, polypharmacy can be one of the leading cause of inappropriate prescription.

Table 7: Polypharmacy distribution in elderly study subjects.

POLYPHARMACY	FREQUENCY(n=330)	PERCENTAGE
No Polypharmacy (0-5)	158	47.88%
Polypharmacy(6-15):	172	52.12%
Minor(6-10)	*92*	*27.88%*
Semi major(11-14)	*48*	*14.%*
Major(14 and above)	*32*	*11.52%*

Figure 7: Graphical representation of polypharmacy distribution elderly study subjects
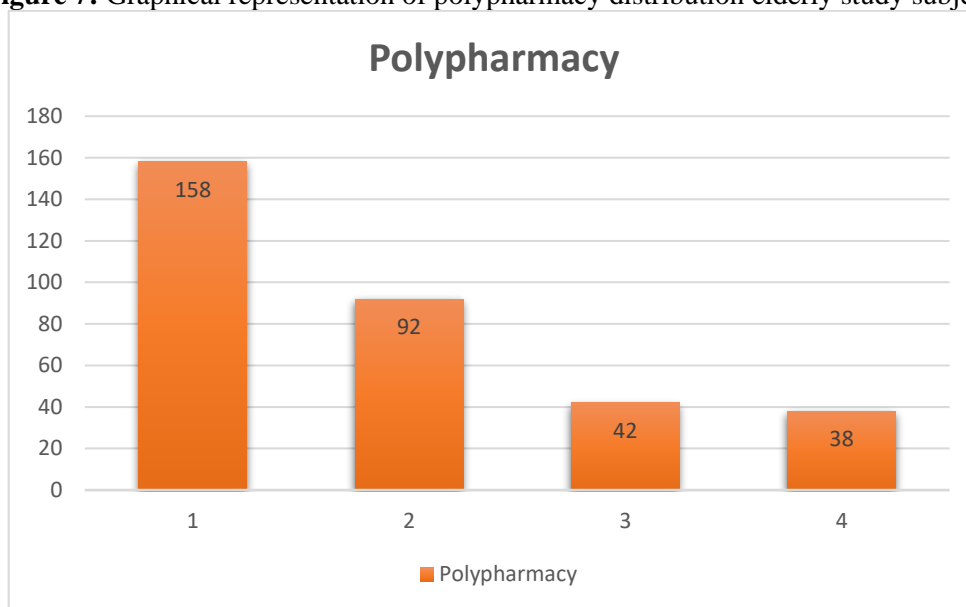
3. DRUG INTERACTIONS

In the study, among the 330 analysed prescriptions we found 187 Drug-Drug Interaction in which 86 (26.06%) had Major drug interactions, 51 (15.45%) had Moderate drug interaction, 50 (15.15%) had Minor drug interactions. In which the most commonly repeated drug interaction was found in the CNS and CVD patients, where Aspirin and furosemide are considered as the lifesaving drugs found to have potential interaction of reduced diuretic effect and nephrotoxicity. The other major interactions found among the geriatric patients with comorbid condition was the concurrent prescription of QT Interval prolonging class of drugs which may reduce the life expectancy of the patients with comorbid condition.

**Major Drug Interaction include**
(include nu of interaction & its percentage example ASPIRIN & FUROSEMIDE = total DDI found in this combination is 05 percentage if major interaction is 100 percentage is 5%)

- **ASPIRIN & FUROSEMIDE**: Concurrent use of LOOP DIURETICS and NSAIDS may result in reduced diuretic effectiveness and possible nephrotoxicity.
- **AZITHROMYCIN & ONDANSETON**: Concurrent use of AZITHROMYCIN and ONDANSETRON may result in an increased risk of QT interval prolongation.
- **CIPROFLOXACIN & ONDANSETON**: Concurrent use of CIPROFLOXACIN and ONDANSETRON may result in an increased risk of QT interval prolongation.
- **AMIODARONE & ONDANSETON**: Concurrent use of AMIODARONE and ONDANSETRON may result in an increased risk of QT interval prolongation.

Table 8: Drug Interaction in the prescription of enrolled patients

DRUG INTERACTION	FREQUENCY(n=330)	PERCENTAGE
No Drug Interaction	143	43.34%
Drug Interaction:	187	56.66%
Minor	*50*	*15.15%*
Moderate	*51*	*15.45%*
Major	*86*	*26.06%*

Figure 8: Graphical representation of drug interactions in the prescription of enrolled subjects
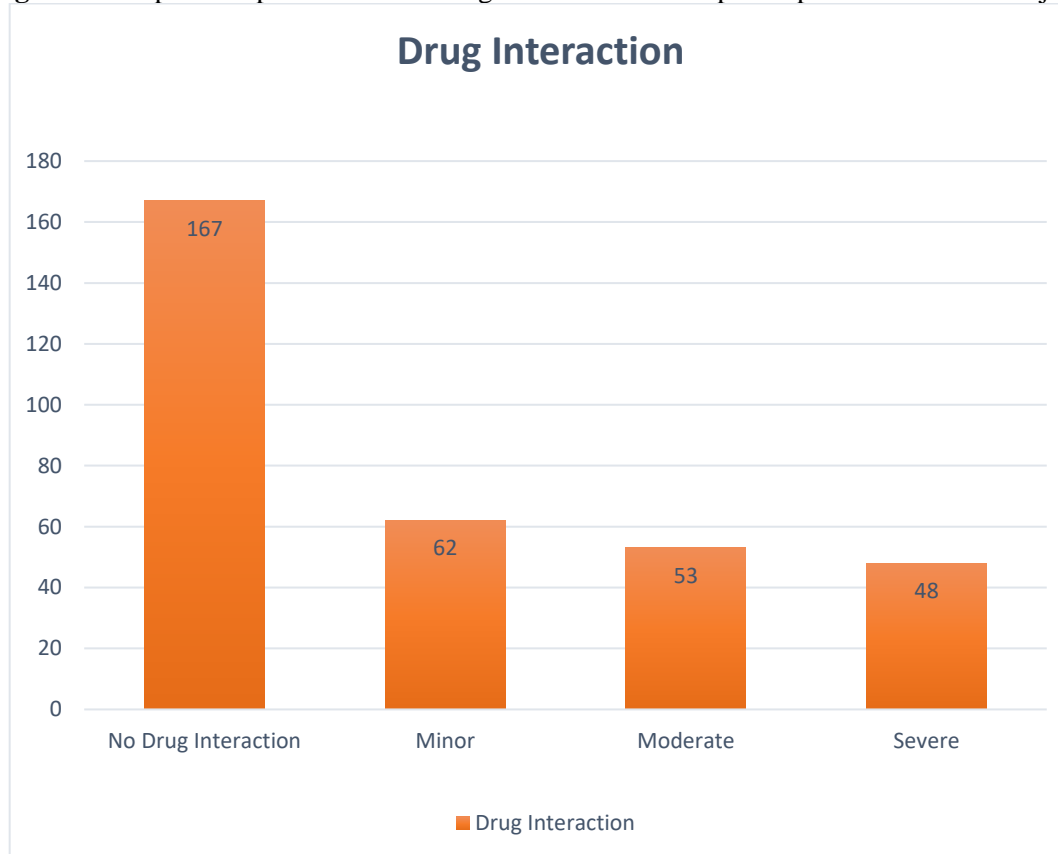
## 4. DISEASE CONDITION OF THE ELDERLY PATIENTS

The assessment of data collected of 330 elderly patients it was evident that the prominent disease condition was Cardiovascular disorder (24.9%), followed by Pulmonary disorder (20.9%) and Endocrine disorder (17.4%). CNS disorders (3.9%) followed by immunocompromised disorders (2.49%) and electrolyte disorders (0.5%) were the least identified disease conditions.

Table 9: Various disease conditions of enrolled elderly patients.

DISEASE CONDITIONS	FREQUENCY(n=330)	PERCENTAGE
CNS Disorders	11	3.33%
CVS Disorders	75	22.7%
Electrolyte Disorders	01	0.33%
Endocrine Disorders	35	10.6%
GIT Disorders	22	6.7%
Hematological Disorders	32	9.7%
Immunocompromised Disorders	05	1.6%
Pulmonary System Disorders	56	16.97%
Renal Disorders	58	17.58%
Brain related Disorders	35	10.6%

Fig 9: Graphical representation of various system of disorders in geriatric patients
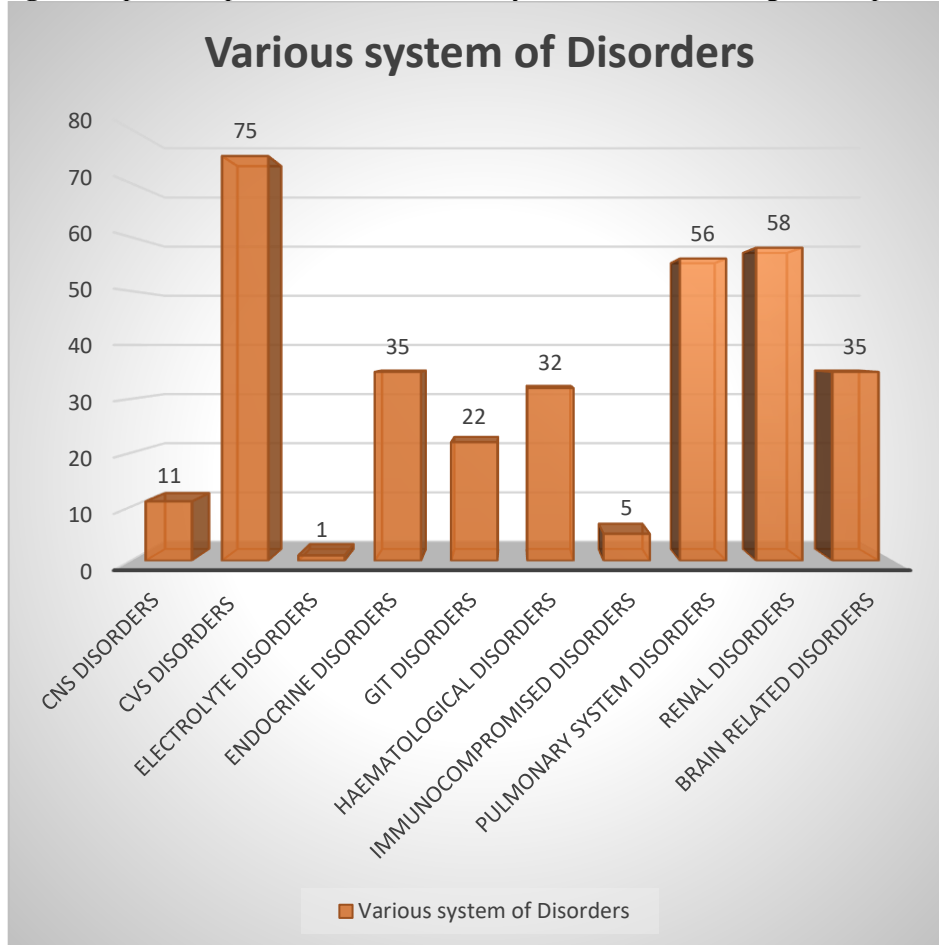

5.DISTRIBUTION OF DISEASES DIAGNOSED IN GERIATRIC PATIENTS

The enrolled study subjects were identified with various kinds of disease in which the prominent disease was found to be hypertension (24.8%) followed by Diabetes mellitus (20.9%).

Table 10: Diseases identified in the enrolled elderly patients

DISEASES	FREQUENCY (n=330)	PERCENTAGE
Anaemia	9	2.7 %
CKD	52	15.7%
COPD	45	13.6%
CVA	38	11.5%
DM	30	9.09%
Infectious Disease	20	6.06%
HTN	51	15.45%
IHD	35	10.6%
Others	50	15.3%

Fig 10: Graphical representation of various diseases in geriatric patients
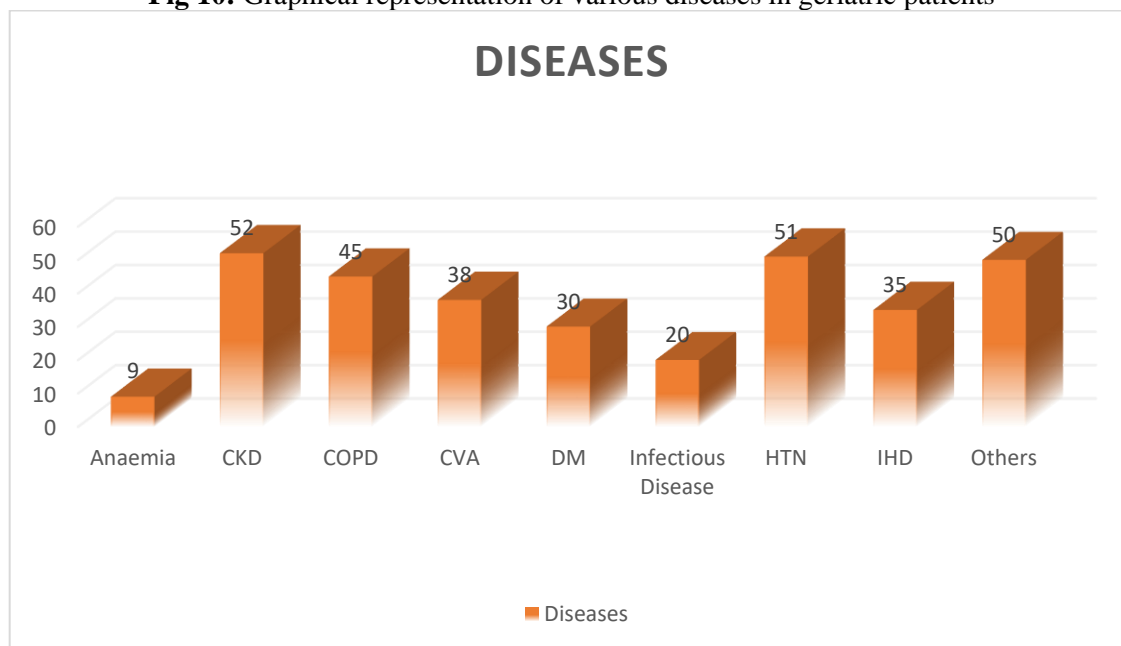
6. BEER'S CRITERIA BASED ASSESSMENT

The highly prescribed drugs which were considered inappropriate are Pantoprazole 210(63.64%), Aspirin 82(24.85%) and Insulin 66 (20%). But there were also some drugs which includes Spironolactone 34 (10.3%) and Clonidine10 (3.03%), are not considered to be appropriate according to the Beer's criteria.

As per the criteria, there are some medications which are to be used with caution in older adults. The results show that the patients were prescribed with Aspirin (24.85%), Diuretics (10.3%), and Tramadol (3.33%) these drugs are to be used with caution.

Table no 11: Beer's criteria-based assessment

Category of Drug *(Independent of Diagnosis)*	No: of patients (%) AGS Beers Criteria 2019	Recommendation	Quality of Evidence	Strength of Recommendation
Pantoprazole	210	Avoid	High	Strong
Aspirin	82	Avoid	Moderate	Strong
Insulin	66	Avoid	Moderate	Strong
Spironolactone	34	Avoid	Moderate	Strong
Glimepiride	12	Avoid	High	Strong
Theophylline	11	Avoid	Moderate	Strong
Tramadol	11	IR: Reduce dose ER: Avoid	Moderate	Strong
Clonidine	10	High	High	Strong
Ciprofloxacin	8	Reduce dose	Moderate	Strong
Metoprolol	7	Avoid	High	Strong
Ranitidine	6	Reduce dose	Moderate	Strong
Nitrofurantoin	6	Avoid	Low	Strong
Diclofenac	5	Avoid	Moderate	Strong
Prazosin	4	Avoid	Moderate	Strong
Leviteracetam	3	Reduce dose	Moderate	Strong
Digoxin	3	Avoid	Low	Strong
Nifedipine	2	Avoid	High	Strong
Clonazepam	2	Avoid	Moderate	Strong
Amiodarone	1	Avoid	High	Strong
Pioglitazone	1	Avoid	High	Strong

7. AGE ASSOCIATED INAPPROPRIATENESS BASED ON BEERS CRITERIA

Beer's criteria, was showing highest inappropriate prescription in the age group between 60-70 years representing 60.30% while least in the age group between 4.2% in 81-90 years.

As assessed by Chi-Square Test, Pearson Chi-Square value was found to be 0.150 and p-value of

the same to be 0.928. The Likelihood Ratio value is 0.146 and p- value is 0.930.

Table no 12: Age associated inappropriateness based on Beers criteria

AGE OF THE PATIENT	BEERS CRITERIA APPROPRIATE	BEERS CRITERIA NOT APPROPRIATE
60-70 YEARS	47	199 (60.30%)
71-80 YEARS	12	54(16.36%)
81-90 YEARS	4	14(4.2%)

8.GENDER ASSOCIATED INAPPROPRIATENESS BASED ON BEERS CRITERIA

The result exhibited that the Beer's criteria show highest inappropriateness in male as 50% and in female as 30.9%.

As assessed by Chi-Square Test, Pearson Chi-Square value was found to be 0.912 and p- value of the same to be 0.340. The Likelihood Ratio value is 0.927 and p-value is 0.336.

Table No 13: Gender associated inappropriateness based on criteria

GENDER OF THE PATIENT	BEERS CRITERIA APPROPRIATE	BEERS CRITERIA NOT APPROPRIATE
MALE	43	165(50%)
FEMALE	20	102(30.9%)

9. NO. OF DAYS OF HOSPITAL STAY ASSOCIATED INAPPROPRIATENESS BASED ON BEERS CRITERIA

Among 330 study subjects, 30.6% of patients stayed for 1-5 days of hospital stay had inappropriateness of Beers criteria.

As assessed by Chi-Square Test, Pearson Chi-Square value was found to be 1.130 and p-value of the same to be 0.568. The Likelihood Ratio value is 1.165 and p value is 0.558.

Table No 14: No. of days of hospital stay associated inappropriateness based on Beer's criteria

NO OF HOSPITAL STAY	BEERS CRITERIA APPROPRIATE	BEERS CRITERIA NOT APPROPRIATE
1-5 DAYS	19	101(30.6%)
6-10 DAYS	18	44(13.33%)
11-15 DAYS	1	6(1.81%)

10. POLYPHARMACY ASSOCIATED INAPPROPRIATENESS BASED ON BEERS CRITERIA

Polypharmacy was categorized and analysed based on the Beers criteria screening tool, it was observed that the highest inappropriately prescribed polypharmacy prescription based on beers criteria was found to be 34.55%.

As assessed by Chi-Square Test, Pearson Chi-Square value was found to be 18.529 and p-value is found to be significant. The Likelihood Ratio value is 20.092 and p- value is found to be significant (p-value <0.05 were considered statistically significant).

Table No 15: Polypharmacy associated inappropriateness based on Beers criteria

NO. OF MEDICATIONS	BEERS CRITERIA APPROPRIATE	BEERS CRITERIA NOT APPROPRIATE
1-5 MEDICATIONS	45	114(34.55%)
6-9 MEDICATIONS	13	79(23.94%)
10-ABOVE	05	74(22.42%)

11.DRUG INTERACTION ASSOCIATED INAPPROPRIATENESS BASED ON BEERS CRITERIA

Among the 330 enrolled subjects, the major drug interaction among the inappropriately prescribed medication based on beers criteria was found to be 24.85%.

As assessed by Chi-Square Test, Pearson Chi-Square value was found to be 29.783 and p- value is found to be significant. The Likelihood Ratio value is 32.941 and p- value is found to be significant (p- value <0.05 were considered statistically significant).

DRUG INTERACTION	BEERS CRITERIA APPROPRIATE	BEERS CRITERIA NOT APPROPRIATE
NO DI	45	98(29.7%)
MINOR	4	46(13.93%)
MODERATE	10	41(12.42%)
MAJOR	04	82(24.85%)

DISCUSSION:

Pharmacotherapy in geriatric patientsis very challenging because of the deteriorating effects of the bodily functions as well as uncertain effects of altered pharmacodynamic and pharmacokinetic changes. As comorbidities increases, the implementation of complex therapeutic regimen gets initiated too. These subsequentially increase the number of medications leading to polypharmacy and potentially inappropriate medications. Without proper assessment of prescribing patterns in geriatric patients, these PIM and polypharmacy can further complicate the patient condition leading to increased mortality and morbidity rate.

Among the 330 elderly subjects enrolled for the study under inclusion criteria, male gender was208 (63.03%) predominant to females by 122 (36.97%). Another study that was conducted in Turkey by Khamis which was similar to our study, where out of 107 participants, 62 were males (57.9) and 45 were females (42.1%).[10]In contradictory, a study by Kose had 102 male participants and 170 female participants in a total of 272 participants.[11]

Based on the study, most of the patients were categorized under the age category between 60-70 years (72.24%) which is then followed by the age group of 71-80(19.7%). The mean value age is 68.27 ± 7.11standard deviation. Also, a similar result of the study conducted byUndelawas found consistent with the present study as more participants from age group between 60-69 years (55.1%).[12]

On assessing the participants based on number of patients' hospital stay, 0-5 days of admission were found out to be 132(65.65%) the highest and the least number of patients (3.5%) stayed for 10- 15 days for the treatment. As a similar study conducted by Undela shows that most patients stayed for 7 days in hospital.[12]

The enrolled study subjects were identified with various kinds of chief complaints such as Respiratory complaints (39.7%) and constitutional complaints (29.4%) which was followed by neurological complaints (15.15%), Gastrointestinal complaints (8.8%), hemorrhagic (1.82%), rash (0.6%).A similar study conducted by Goudanavar provide a similar results in which majority cases were from the respiratory clinic (28%).[13] However, a similar study conducted by Khamis yielded contradictory results in which majority cases of 40.2% participants had cardiovascular complaints.[10] Specific versus Non-specific complaints implicate that the majority of our study subjects 44.24% presented specific complaints whereas 55.76% presented non-specific complaints. A study by Sauter describes about aNon-specific complaint in patients admitted to an emergency department result in low-qualitydiagnoses and lengthened hospitalization, despite the patients being comparable to patients with specific complaintsat admission.[14]

Assessing the enrolled patients for social history, it was identified that, out of 330 subjects, 280(84.85%) had no record of social habits whereas 10(3.03%) were alcoholic, 29 (8.79%) were smokers and 11(3.33%) were both. Comparably,more than half were found to be non-smokers and non-alcoholics which was observed by similarstudy conducted by Undela[12]

Among 330 study subjects, 11.52% of prescriptions were found to have major polypharmacy with prescribed drugs of count of 14 drugs and above, 14% were semi-major polypharmacy and there were no polypharmacy prescriptions in 47.88% of cases. It was observed that, polypharmacy can be one leading cause for the inappropriateness of the prescription.The study performed by Karandikar showed that majority of prescription do not exhibit polypharmacy.[15] In the study conducted by Rakesh revealed that frequency of minor polypharmacy (260) was more which is conflicting from our study.[16]

After the analysis of prescription, it was observed that 26.06% had major drug interactions, 15.45% had moderate drug interaction, 15.15% had minor drug interactions while half of the prescription 43.34% was prescribed with no drug interactions**.** Chitra carried out a study on drug interactions in elderly revealed that 68% of the patients had drug interactions which contradicts our study.[17] On admission 52.69% potential drug-druginteractions were observed by Salwe and they concluded that polypharmacy leads to more potential drug-drug interactions.[18] Micromedex drug data base was used to check drug interactions and were evaluated and categorized into major, moderate and minor based on their severity.

The assessment of data collected of 330 elderly patients it was evident that the prominent disease condition was Cardiovascular disorder (22.7%), followed by Pulmonary disorder (16.97%) and Endocrine disorder (10.6%). CNS disorders (3.33%) followed by immunocompromised disorders (1.6%) and electrolyte disorders (0.33%) were the least identified disease conditions. From the study conducted by Karandikar commonly

found PIM were cardiovascular system (14),respiratory system (4), which associates to our study.[15]Veenaconducted a study among the elderly at Bangalore reported that respiratory and cardiovascular diseases were shown to be the predominant reasons for admission.[19]

As mentioned in Beer's criteria for the elderly, various drugs that are found to be inappropriate are required to be avoided or used in caution in their treatment regimen.Our study commences that the most commonly used inappropriate drugs are Pantoprazole (210), Aspirin (82) and Insulin (66). But there were also some drugs which includes Spironolactone (34) and Clonidine (10), are not considered to be appropriate according to the Beer's criteria. As per the criteria, there are some medications which are to be used with caution in older adults. The results show that the patients were prescribed with Aspirin (82), Tramadol (11) that has to be either avoided or used with caution. These drugs are to be used with caution but are not considered to be inappropriate because aspirin administered in a dose above 325 is considered to be inappropriate in the elderly, pantoprazole if used more than 8 weeks and human insulin administering in higher risk of having hypoglycemia without improvement in hyperglycemia management is inappropriate, but in our subjects, this type of prescriptions were not observed. A study by Khamis showed similar results with ours as the pantoprazole (37) was highest inappropriately prescribed drug[10]. Slightly similar results were obtained from a study conducted by Pradhan that is lorazepam (18%) being the highest inappropriately prescribed drug.[20]

The enrolled study subjects were identified with various kinds of disease in which the prominent disease was found to be hypertension (24.8%) followed by diabetes mellitus (20.9%). From the study conducted by Abdelmoneim A, Oliva H based on Beer's criteria, revealed that most frequent diseases were hypertension (330) and diabetes mellitus (272) which correlates with our study. [21]

CONCLUSION:
Geriatric patients usually have increased risk of comorbidities and are more likely to be prescribed with numerous medicines concomitantly, increasing the risk of ADE and Drug Interactions. Our study mainly focused on the inappropriate use of medications in the elderly patients which finally summarized that inappropriate prescription in the elderly is found to be suboptimal and are required

to provide an immediate attention and concern of medical practitioners regarding the multiple prescriptions of the geriatric population. Even though multiple drugs are often necessary to treat concomitant disease state in elderly patients, avoidable irrelevant addition of medications, complexity and cost of the drug regimen, compliance can reduce the adherence of treatment. The pharmacological treatment and inappropriate medicine uses are rarely discussed in regular clinical practice. The study conducted in accordance with the Beer's criteria had critically sorted out various drugs that are found to be inappropriate and has to be avoided or used with caution in their treatment regimen. Pharmacist must indulge in effective interventions with the practitioners in order to minimize prevalence of PIM in older adults. The geriatric pharmacovigilance must be taken seriously and should focus on the benefit rather than appropriateness. Polypharmacy, defined as the use of five or more drugs, is a significant public health problem, particularly in the older patients, since it is frequently responsible for the rise of morbidity and mortality. The statistically significant findings of this study on inappropriate use of medicines elucidate a valid evidence for the same. The current literatures and recent publications emphasize more on the need of appropriate prescribing to avoid medication and economic burden as well as the need of promoting rational drug usage in geriatric patients. Prescription pattern assessment elucidates the common prescribing errors and thereupon, helps prescribers as well as pharmacist to formulate various methods and measures for improving the life expectancy mainly in the elderly and also to provide a better patient care.

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Available data and materials:
All the information related to the study is embedded within the manuscript.

Conflict of Interest:
The authors declare no conflict of interest

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