



A Prospective Observational Study on Potentially Inappropriate Medications in Geriatrics Using Beer's Criteria

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KEYWORDS

Beers Criteria, Potentially inappropriate medications, Comorbidities, Prescription.

ABSTRACT:

Background: The major cause of adverse drug events in geriatrics is inappropriate prescribing of medications and this may lead to morbidity and mortality. The American Geriatrics Society Beers Criteria (AGS Beers Criteria) for potentially inappropriate use of medications in older adults are used widely. The final updated criteria has three categories: a) Potentially inappropriate medications and classes to avoid in older adults, b) Potentially inappropriate medications and classes to avoid in older adults with certain diseases and syndromes, c) Medications to be used in caution in older adults.

Objective: The objective of the study is to evaluate the use of potentially inappropriate medications in older adults using Beers Criteria.

Materials and Method: A Prospective Observational Study was conducted in the major departments (General Medicine, General Surgery, Orthopedics and Respiratory Medicine) of multispecialty Hospital, Virudhunagar. The study was conducted over a period of 6-8 months.

Results: 107 elderly patients with age above 65 years were included in the study. Out of these 107 patients 87% of the patients were with comorbidities and 13% of the patients were without comorbidities. A total of 1142 drugs were prescribed as an average of 10.6 drugs per patient. Among 107 patients 96 patients (89.7%) were prescribed with inappropriate drugs and 11 patients (10.3%) were prescribed with appropriate drugs. A total of 256 inappropriate drugs (22.4%) were prescribed. Among these 256 inappropriate drugs, 21 patients(19.6%) received one inappropriate medication, 36 patients(33.6%) received two inappropriate medications, 15 patients(14%) received three inappropriate medications, 12 patients(11.2%) received four inappropriate medications, 3 patients(2.8%) received five inappropriate medications, 8 patients(7.5%) received six inappropriate medications and 1 patient(0.9%) received seven inappropriate medications.

Conclusion: The risk of potentially inappropriate medications is increasing day by day due to inappropriate prescribing. The physician should consider the age, pharmacokinetics, pharmacodynamics and comorbidities of the patient while prescribing medications. A multidisciplinary team should be appointed in every hospital to find out the inappropriate prescribing and to evaluate medication adherence. Rational drug use should be practiced.



INTRODUCTION

Ageing, an inevitable process, is commonly measured by chronological age and, as a convention, a person aged 65 years or more is often referred to as 'elderly'. However, the ageing process is not uniform across the population due to differences in genetics, lifestyle, and overall health^[1]. The growth of the aging population leads to the increase of chronic diseases, burden of multi-morbidity, and of the complexity polypharmacy. The prevalence of medication errors rises in patients with polypharmacy in primary care, and this is a major concern to healthcare systems^[2]. The older, multi-morbid population with chronic conditions is expanding globally, and this inevitably means a growth in complex polypharmacy and associated problems^[2].

Beer's Criteria:

The Beers Criteria was first developed in 1991 by Mark H. Beers, MD, to decrease inappropriate prescribing and ADEs and in particular, to identify medications or medication classes that should be avoided in older adults in nursing homes. In 2011, after Beers's death, the American Geriatrics Society (AGS) began to oversee the revisions and updates to the criteria. AGS has provided updates to the criteria every 3 years, starting in 2012. In January 2019, AGS published the latest update to the Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. This update includes specific recommendations for a medication or therapeutic class that should not be considered or should be used with caution in older adults^[3].

The American Geriatrics Society (AGS) Beers Criteria (AGS Beers Criteria) for Potentially Inappropriate Medication (PIM) Use in Older Adults are widely used by clinicians, educators, researchers, healthcare administrators, and regulators. Since 2011, the AGS has been the steward of the criteria and has produced updates on a 3-year cycle. The AGS Beers Criteria is an explicit list of PIMs that are typically best avoided by older adults in most circumstances or under specific situations, such as in certain diseases or conditions^[4]. Fifty-three medications or medication classes encompass the final updated criteria, which are divided into three categories: Potentially inappropriate medications and classes to avoid in older adults, potentially inappropriate medications and classes to avoid in older adults with certain diseases and syndromes that the drugs listed can exacerbate,

and finally medications to be used with caution in older adults. This update has much strength, including the use of an evidence-based approach using the Institute of Medicine standards and the development of a partnership to regularly update the Criteria. Thoughtful application of the Criteria will allow for (a) closer monitoring of drug use, (b) application of real-time e-prescribing and interventions to decrease ADEs in older adults, and (c) better patient outcomes^[5]. Poly pharmacy is often defined as the use of five or more medications, is prevalent in adults ages 65 years and older, with 40% taking 5 to 9 medications and 18% taking 10 or more. Poly pharmacy can result in inappropriate prescribing of medications, causing adverse drug events (ADEs). 2 Studies have shown that ADEs in older adults can lead to increased emergency department visits and hospitalizations, resulting in increased healthcare utilization and cost^[3].

Key Principles to Guide Optimal Use of the American Geriatrics Society Beer's Criteria:

- a. Medications in the 2019 AGS Beers Criteria are potentially inappropriate, not definitely inappropriate.
- b. Read the rationale and recommendations statements for each criterion. The caveats and guidance listed there are important.
- c. Understand why medications are included in the AGS Beers Criteria, and adjust our approach to those medications accordingly.
- d. Optimal application of the AGS Beers Criteria involves identifying potentially inappropriate medications and where appropriate offering safer non-pharmacological and pharmacological therapies.
- e. The AGS Beers Criteria should be a starting point for a comprehensive process of identifying and improving medication appropriateness and safety.
- f. Access to medications included in the AGS Beers Criteria should not be excessively restricted by prior authorization and/or health plan coverage policies.
- g. The AGS Beers Criteria are not equally applicable to all countries.



Updates to the AGS Beers Criteria:

The writing committee for the 2019 update was tasked with the following:

- a. Incorporate new evidence on potentially inappropriate medications (PIMs) included in the 2015 AGS Beer's Criteria, as well as develop new or modify existing criteria.
- b. Grade the strength and quality of each PIMs statement based on the level of evidence and strength of recommendation^[18].

METHODOLOGY

A Prospective Observational study was conducted in 107 geriatric patients from major departments (General Surgery, General Medicine, Orthopedics, Respiratory Medicine) of

multispecialty Hospital, Virudhunagar. The study was conducted over a period of 6 months.

Study Criteria

Inclusion Criteria

- a. Patients of age ≤ 65 years.
- b. Patient with and without comorbidities.
- c. Patient with willingness.
- d. Patient of both genders.

Exclusion Criteria

- a. Patients below 65 years of age.
- b. Not willing to participate in the study.

RESULTS

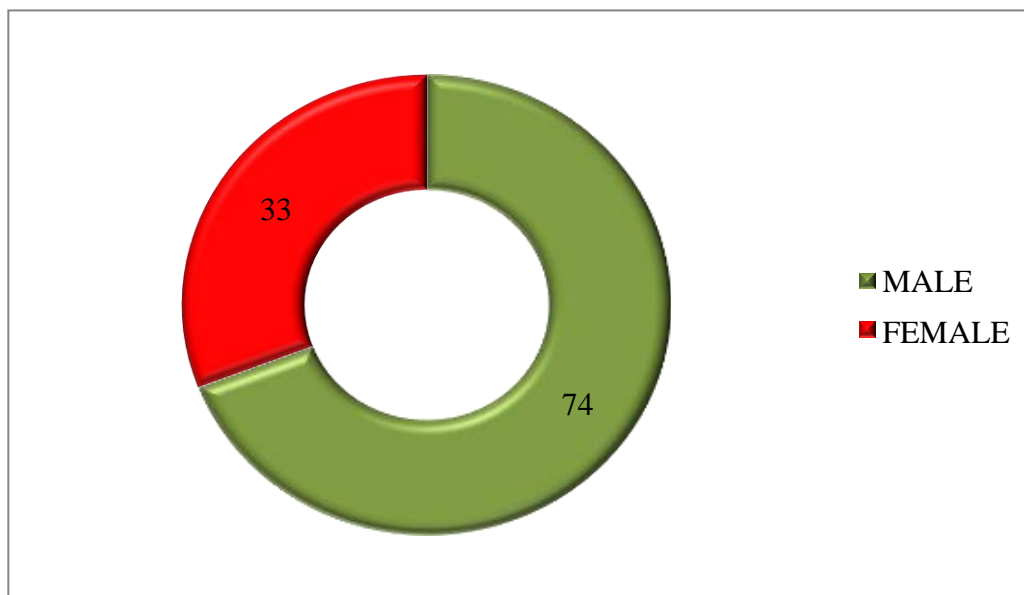


FIGURE1: GENDER WISE CLASSIFICATION

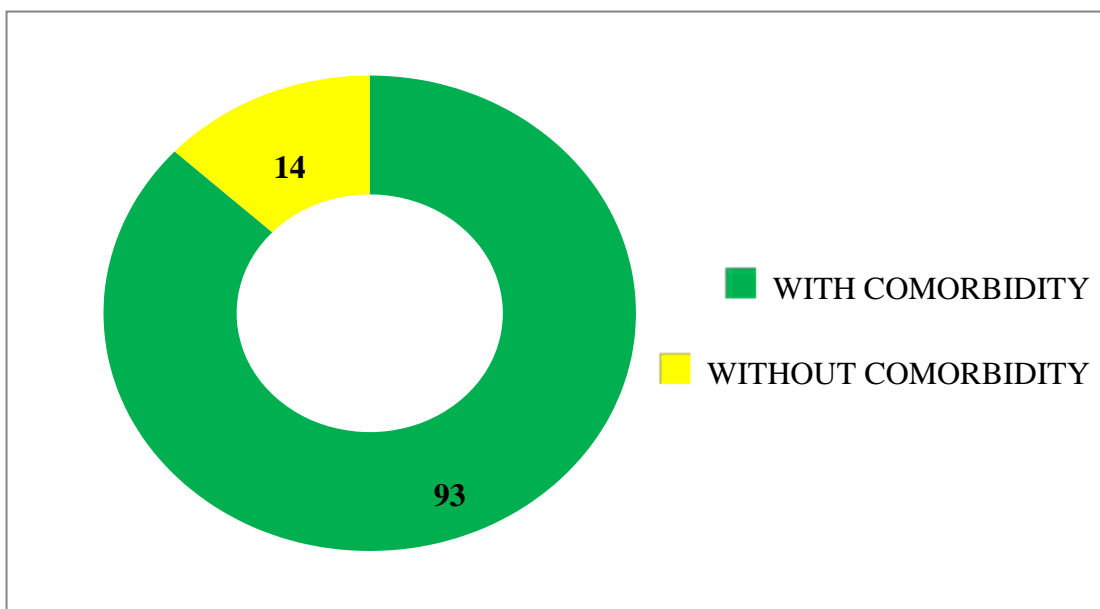


FIGURE 2: COMORBIDITY WISE CLASSIFICATION

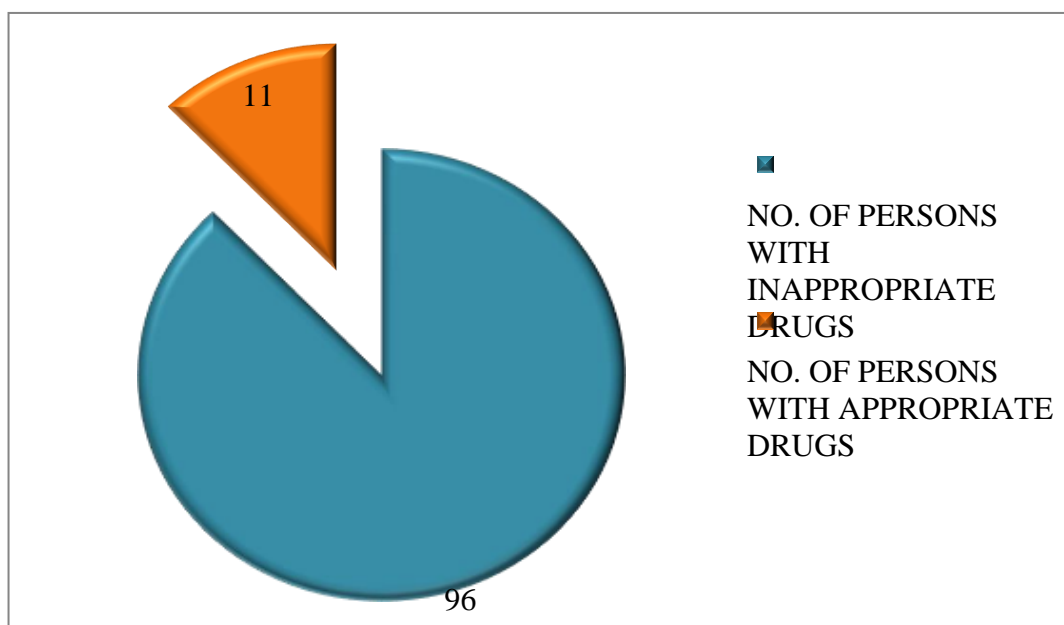


FIGURE 3: PATIENT RECEIVING APPROPRIATE AND INAPPROPRIATE DRUGS

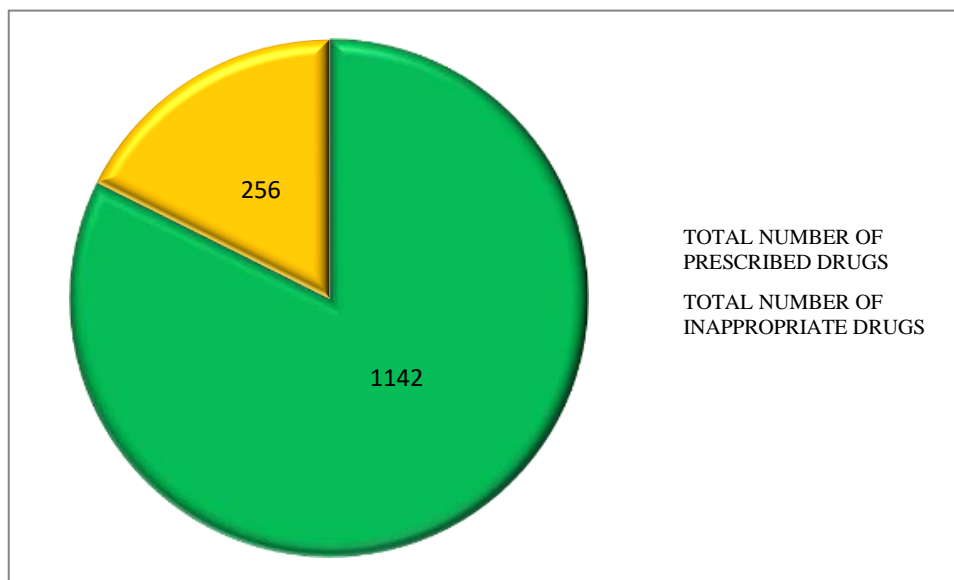


FIGURE 4: TOTAL NO.OF DRUGS PRESCRIBED AND NUMBER OF INAPPROPRIATE DRUGS

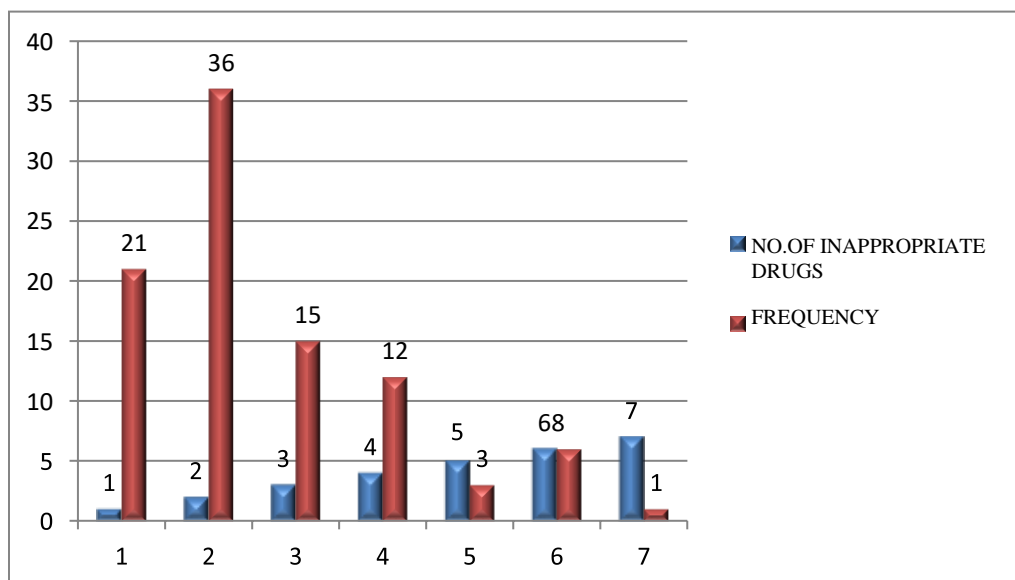




TABLE 1: PRESCRIBED DRUGS IN GERIATRICS THAT SHOULD BE AVOIDED BASED ON BEER'S CRITERIA

S.No	Drugs in PIM	Frequency	Potential Risk
1	METOCLOPRAMIDE	1	Can cause extrapyramidal effects, including tardive dyskinesia; risk may be greater in frail older adults and with prolonged exposure.
2	CIPROFLOXACIN	1	Increased risk of CNS effects(eg, seizures, confusion) and tendon rupture.
3	SODIUM VALPORATE	1	Any combination of three or more of these CNS-active drugs.
4	IBUPROFEN	1	Increased risk of gastrointestinal bleeding or peptic ulcer disease in high-risk groups Potential to promote fluid retention and /or exacerbate heart failure with reduced ejection fraction.
5	AMIODARONE	1	Effective for maintaining sinus rhythm but has greater toxicities than other anti arrhythmics used in atrial fibrillation; may be reasonable first-line therapy in patients with concomitant heart failure or substantial left ventricular hypertrophy if rhythm control is preferred over rate control.
6	LORAZEPAM	1	Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long acting agents; in general, all benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motor vehicle crashes in older adults.
7	CHLORPROMAZINE	1	Increased risk of cerebro vascular accident (stroke) and greater rate of cognitive decline and mortality in persons with dementia Avoid antipsychotics for behavioral problems of dementia or delirium unless non pharmacological options (eg,behavioral interventions) have failed or are not possible and the older adult is threatening substantial harm to self or others Avoid, except in schizophrenia or bipolar disorder, or for short-term use as antiemetic during chemotherapy.
8	GLIMEPRIDE	2	Higher risk of severe prolonged hypoglycemia in older adults.
9	DICYCLOMINE	2	Highly anticholinergic, uncertain Effectiveness.



10	AMITRIPTYLINE	2	May exacerbate or cause SIADH or hyponatremia; monitor sodium level closely when starting or changing dosages in older adults.
11	SEPTRAN	2	Increased risk of hyperkalemia when used concurrently with an ACEI or ARB in presence of decreased creatinine clearance.
12	REGULARINSULIN	4	Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting. Avoid insulin regimens that include only short- or rapid acting insulin dosed according to current blood glucose levels without concurrent use of basal or long-acting insulin. This recommendation does not apply to regimens that contain basal insulin or long-acting insulin.
13	DIAZEPAM	4	Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long acting agents; in general, all benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motor vehicle crashes in older adults.
14	HUMAN MIXTARD INSULIN	4	Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting. Avoid insulin regimens that include only short- or rapid acting insulin dosed according to current blood glucose levels without concurrent use of basal or long-acting insulin. This recommendation does not apply to regimens that contain basal insulin or long-acting insulin.
15	DICLOFENAC	5	Increased risk of gastrointestinal bleeding or peptic ulcer disease in high-risk groups Potential to promote fluid retention and/or exacerbate heart failure with reduced ejection fraction.
16	NIFEDIPINE	5	Potential for hypotension; risk of precipitating myocardial Ischemia.
17	DIGOXIN	7	QE for atrial fibrillation.
18	TRAMADOL	7	May exacerbate or cause SIADH or hyponatremia; monitor sodium level closely when starting or changing dosages in older adults.
19	MANNITOL	9	May exacerbate or cause SIADH orhyponatremia; monitor sodium level closely when starting or changing dosages in older adults.



20	OMEPRAZOLE	10	Risk of Clostridium difficile infection and bone loss and fractures.
21	HUMAN ACTRAPID INSULIN	11	Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting. Avoid insulin regimens that include only short- or rapid acting insulin dosed according to current blood glucose levels without concurrent use of basal or long-acting insulin. This recommendation does not apply to regimens that contain basal insulin or long-acting insulin.
22	CHLORPHENIRAMINEMAL EATE	12	Highly anticholinergic; clearance reduced with advanced age, and tolerance develops when used as hypnotic; risk of confusion, drymouth, constipation, and other anticholinergic effects or toxicity.
23	SPIRONOLACTONE	14	May exacerbate or cause SIADH or hyponatremia monitor sodium level closely when starting or changing dosages in older adults.
24	RANITIDINE	16	Mental status changes.
25	ALPRAZOLAM	23	Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long acting agents; in general, all benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motorvehicle crashes in older adults.
26	ASPIRIN	44	Risk of major bleeding from aspirin increases markedly in older age. Several studies suggest lack of net benefit when used for primary prevention in older adult with cardiovascular risk factors, but evidence is not conclusive. Aspirin is generally indicated for secondary prevention in older adults with established cardiovascular disease.
27	FUROSEMIDE	45	May exacerbate or cause SIADH or hyponatremia; monitor sodium level closely when starting or changing dosages in older adults.

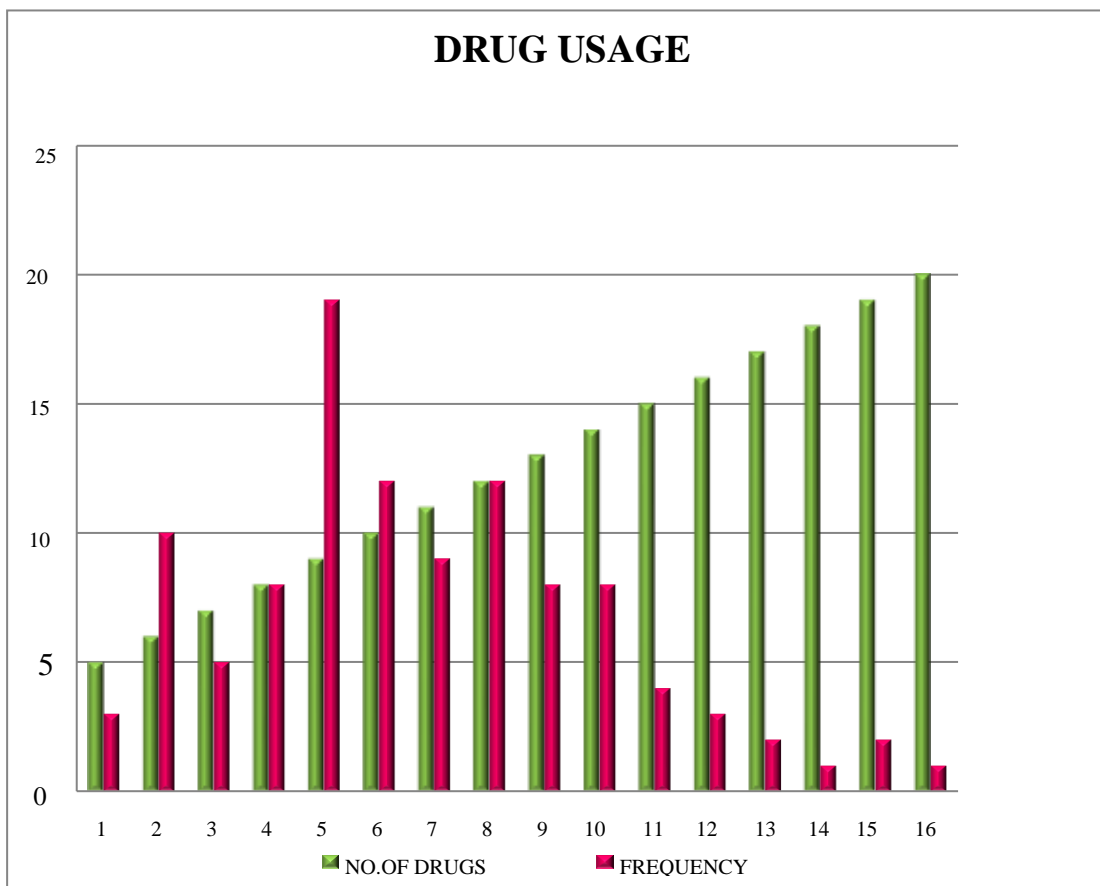


FIGURE8: DRUG USAGE AND THEIR FREQUENCY

DISCUSSION

There was 107 elderly patients were included in the study. Patients with age of above 65years were considered with average age of 70 years were involved in the study which includes 74 male patients and 33 female patients. Of these 107 patients 87 % of patients are with comorbidities and 13% of the patients were without comorbidities. A total of 1142 drugs were prescribed to the patients which includes an average of 10.6 drugs per patient. Among 107 patients 95 patients were prescribed within appropriate drugs, 12 patients were not prescribed with any inappropriate drugs. In the total 1142 drugs prescribed, 244 inappropriate drugs were prescribed. Among these 245 inappropriate drugs, 21 patients received one inappropriate drug, 36 patients

received two inappropriate drugs, 15 patients received three inappropriate drugs, 12 patients received four inappropriate drugs, 3 patients received five inappropriate drugs, 8 patients received six inappropriate drugs, 1 patient received seven inappropriate drugs. Furosemide, a loop diuretic is an inappropriate medication in geriatrics has higher frequency of prescription of 45 times. Aspirin, an Anti-inflammatory, Anti-Platelet drug to be used in caution in geriatrics has frequency of prescription of 44 times. Alprazolam, an Antipsychotic drug, an inappropriate medication has frequency of prescription of 23 times. Ranitidine, a H2 receptor blocker, to be avoided in patients with CKD patients has frequency of prescription of 16 times. Spironolactone, a Potassium sparing diuretics, an



inappropriate medication in geriatrics has frequency of prescription of 14 times. Chlorpheniramine Maleate, Anti-histamine, an inappropriate medication in geriatrics has frequency of prescription of 12 times.

Human Actrapid insulin, a hypoglycemic agent is an inappropriate medication in geriatrics has frequency of prescription of 11 times. Omeprazole, a Proton pump inhibitor, an inappropriate medication in geriatrics has frequency of prescription of 10 times. Mannitol, an Osmotic diuretic, an inappropriate medication in geriatrics has frequency of prescription of 9 times. Tramadol, an Opioid analgesic, an inappropriate medication in geriatrics has frequency of prescription of 7 times. Digoxin, a Cardiac Glycoside, an inappropriate medication in geriatrics has frequency of prescription of 7 times. Nifedipine, a Calcium Channel Blocker, an inappropriate medication in geriatrics has frequency of prescription of 5 times. Diclofenac, Non-Steroidal Anti-inflammatory drug, an inappropriate medication in geriatrics has frequency of prescription of 5 times. Human mixtard insulin, a Hypoglycemic agent, an inappropriate medication in geriatrics has frequency of prescription of 4 times. Diazepam, a Benzodiazepine, an inappropriate medication in geriatrics has frequency of prescription of 4 times. Regular insulin, a Hypoglycemic agent, an inappropriate medication in geriatrics has frequency of prescription of 4 times. Phenytoin, an Anti-epileptic drug, an inappropriate medication in geriatrics has frequency of prescription of 3 times. Septran, an Antibiotic, an inappropriate medication in geriatrics has frequency of prescription of 2 times.

Amitriptyline, a Tricyclic Anti-depressant, an inappropriate medication in geriatrics has frequency of prescription of 2 times. Dicyclomine an inappropriate medication in geriatrics has frequency of prescription of 2 times. Glimepride, a Hypoglycemic agent, an inappropriate medication in geriatrics has frequency of prescription of 2 times. Chlorpromazine, antiemetic agent, an inappropriate medication in geriatrics has frequency of prescription of 1 time. Lorazepam, an inappropriate medication in geriatrics has frequency of prescription of 1 time. Amiodarone, an inappropriate medication in geriatrics has frequency of prescription of 1 time. Ibuprofen, an Anti-inflammatory drug, an inappropriate medication in geriatrics has frequency of prescription of 1 time. Sodium Valporate, a Anti-epileptic

agent, an inappropriate medication in geriatrics has frequency of prescription of 1 time. Ciprofloxacin, a quinolone antibiotic, to be avoided in patients with CKD patients has frequency of prescription of 1 time. Metoclopramide, inappropriate medication in geriatrics has frequency of prescription of 1 time. Prednisolone, a Corticosteroid produces drug-drug interaction when given with diclofenac has frequency of prescription of 1 time. Deriphylline, a Xanthine derivative produces drug-drug interaction when given with prednisolone has frequency of prescription of 1 time. Enalapril, a ACE inhibitor produces drug-drug interaction when given with spironolactone has frequency of prescription of 6 times.

CONCLUSION

In geriatrics, with several chronic conditions leading to poly pharmacy are more susceptible to develop potentially inappropriate medications, drug-drug interactions and adverse drug reactions which causes several harm to the patients. The risks of potentially inappropriate medication are increasing day by day due to inappropriate prescribing. The physician should consider the age, pharmacokinetics, pharmacodynamics of the patient and prescribe them according to the standard prescribing guidelines. The physician should examine prescription and over-the-counter medications used by the elderly during the visit. It will be useful to establish a warning system stating that PIMs are available for particular patient. So, it will be possible for health authorities to re-evaluate the treatment and replace PIMs with rational drug options. Eventhough several criteria were available for finding the potentially inappropriate medications, they had been not properly followed by every hospitals and physicians. Every criteria available for finding the PIM'S has their own limitations. In future also, there will be more new criteria's with strong study design developed for finding the PIM'S. There is no use in developing the criteria only, they will be effective when they are being utilized. If physician follows standard prescribing guidelines there is no need in such criteria. A multidisciplinary team to be appointed in each and every institution to find the inappropriate prescribing and assess the adherence towards the criteria.



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