

“Insights into Elderly Medication Practice: A Prospective Observational Study on Beers Criteria Polypharmacy And Gfi”

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ABSTRACT

The elderly population has constantly been rising over the past few years. As far as drug prescribing is concerned, this population is considered to be a particular risk group, as polypharmacy and age-related physiological changes make them more vulnerable to the harmful effects of drugs. Frailty is characterized by reduced physiological reserve and increased vulnerability to adverse outcomes after stress or events. Frailty is measured using the Groningen Frailty Index. Prescription drugs for the elderly is a challenging task. There are different tools to assess the appropriateness of prescriptions in geriatrics. These include Beer's criteria, polypharmacy, and GFI. The study's main objective was to evaluate frailty, assess polypharmacy and associated DDIs, and assess the appropriateness of prescriptions among geriatric patients in a tertiary care hospital. A prospective observational study was carried out on geriatric patients (> 65 years) of either gender for a period of 7 months with a validated data collection form. Two participants were completely disabled, i.e., GFI score 4, totally confined to bed. Polypharmacy was present in 74% of prescriptions, and there were 495 DDIs detected among the prescriptions of 150 participants. 50 (33.3%) Patients were on at least one potentially inappropriate medication as per Beer's criteria. A study showed frailty, polypharmacy, associated DDIs are highly prevalent in the geriatric population, which has a significant healthcare outcome. Various criteria, referred to as the golden standard, should be considered before prescribing medications to the geriatric population.

Keywords: Geriatrics, Beer's criteria, DDI, frailty.

I. INTRODUCTION:

Ageing is a biological process with its own dynamics that are primarily out of human control. To put it another way, ageing is an incurable illness.^[1]

The elderly population in India is growing steadily by 8.6% as of the 2011 census. Also, India's elderly population (above 60 years) is estimated to reach 194 million by 2031 from 138

million in 2021, so a 41% rise in this population is seen over a decade, according to the National Statistics Office's (NSO's) Elderly in India 2021 report.^[2]

The geriatric population is the largest consumer of medication among different age groups. Prescribing medication to this vulnerable group requires a high level of vigilance, as these people have an increased risk of developing ADRs due to the modification of the pharmacokinetics and pharmacodynamics of drugs as a consequence of age-related changes in physiology.^[3]

Frailty can be commonly defined as a complex geriatric syndrome that leads to a decrease in physiological reserves with increasing age. It is characterized an enhanced susceptibility to adverse health consequences among the geriatric population. Elderly people who are frail frequently have more symptoms, such as weakness and lethargy, more complex medical conditions to treat, and a reduced tolerance for both medical and surgical procedures. The decline in physiological reserve comes with ageing, however, and with frailty, this decline is accelerated, and the ability to maintain homeostasis starts to deteriorate. Frailty has been proven to be a key barrier to the selection of drug therapy among the older population. Frailty can be quantified using GFI. Which include 151 dichotomous items related to vision, hearing, cognition, nutrition, mobility, psychosocial capabilities, and physical health. The score can range from 0 (zero) to 1 (regular activity without any restriction) to 15 (absolutely disabled). Subjects with a GFI rating of 4 and above are taken into account as frail.^[4]

Chronic diseases and polypharmacy among the elderly population boost the risk of inappropriate drug usage. The use of drugs inappropriately has a negative impact on patients and drives up healthcare expenses. There is no universally accepted agreement related to the definition of polypharmacy. Polypharmacy just implies multiple drug uses by an individual patient. In the current study, when a patient took five or

more medications at once, polypharmacy was taken into account.^[5]

Beer's criteria for potentially inappropriate medication use in older adults (geriatrics) is also known by the name Beer's list. These guidelines in the Beer's criteria assist medical practitioners in improving the safety of drug prescriptions for patients over 65 years old. Beer's criteria include a list of medications for which the risks may outweigh the benefits for those 65 years of age and older. By taking this information into account, doctors can minimize the adverse effects of such medications.

The Beers Criteria was formulated by geriatrician Mark H. Beers using an expert consensus panel using the Delphi method. This procedure was initially published in the Archives of Internal Medicine in 1991 and was revised in the following years: 1997, 2003, 2012, and 2015; the most recent revision was done in January 2019.^[6]

II. MATERIALS AND METHODS

STUDY DESIGN: Prospective Observational study

STUDY SITE: The study was conducted at Srinivas Institute of Medical Science and Research Centre, Mukka-574146

STUDY DURATION: The study was conducted for duration of 7 months from January 2022 to July 2022.

SAMPLE SIZE: The study was limited for a sample of 150 based on the time Schedule allotted for the project including other circumstances.

ETHICAL CLEARANCE: The study protocol was approved by the Institutional Ethics Committee (IEC) of Srinivas Institute of Medical Science, Mukka, Mangaluru.

STUDY CRITERIA

Inclusion criteria:

- Patients of either gender
- Patients aged ≥ 65 years
- Patient suffering from acute or chronic diseases

Exclusion criteria:

- Vitamins, minerals and herbals
- Patients who are aged less than 65 years
- Prescriptions containing incomplete information
- Patients with short duration of hospitalization (less than 24 h) or day care(Out-patients).

SOURCE OF DATA

Data(s) for the study were collected using data collection form from the In-Patient medical files of patients admitted at Srinivas Hospital, Mukka-574146 and through direct interaction with the patient, nurse and other staffs.

STUDY METHOD

Preparation of Inform Consent Form:

Inform consent form was prepared in Kannada and English and same were used. Before selection of subjects the consent form was orally explained to the participants before filling it and nonverbally by taking help of caregiver and staffs who are well known of the subjects at the hospital and made them understood. In the study only the participants willed to fill ICF were included.

Data(s) collection:

Data(s) were collected using data collection form with the aid of in-patient medical records and through direct interaction with the patient, nurse and other staffs from the hospital. Data collected include age, gender, social history, details of co morbid diseases, medication history, medical history, findings of clinical examination, drug treatment chart, etc.

III. DATA ANALYSIS

The collected data(s) were analyzed using Microsoft excel (version 2208) and Karl Pearson correlation was used to observe relationship between PIMs and co morbidity and PIMs with number of drugs prescribed.

IV. RESULT:

Demographic characteristics of participants

The present study included a total of 150 participants from various departments of a tertiary care hospital (Srinivas hospital, Mukka-574146). Of these participants 50.6% (76) were male and 49.3% (74) were female. The participants were also distributed according to age group to compare the probability of greater incidents of PIM in different age group. In the current study it was found that majority of the participants (85) belong to the age group of 65-70 Years, 51 participants belong to age group 71-80 Years and 12 participants belonged to age group 81-90 Years and there were only 2 participants who were aged above 91 years.

Table 1: Demographics of study participants

Population characteristics	Number
Total patients	150
Male	76
Female	74
Age group (in years)	
65-70 y	85
71-80 y	51
81-90 y	12
>91 y	2

Frailty:

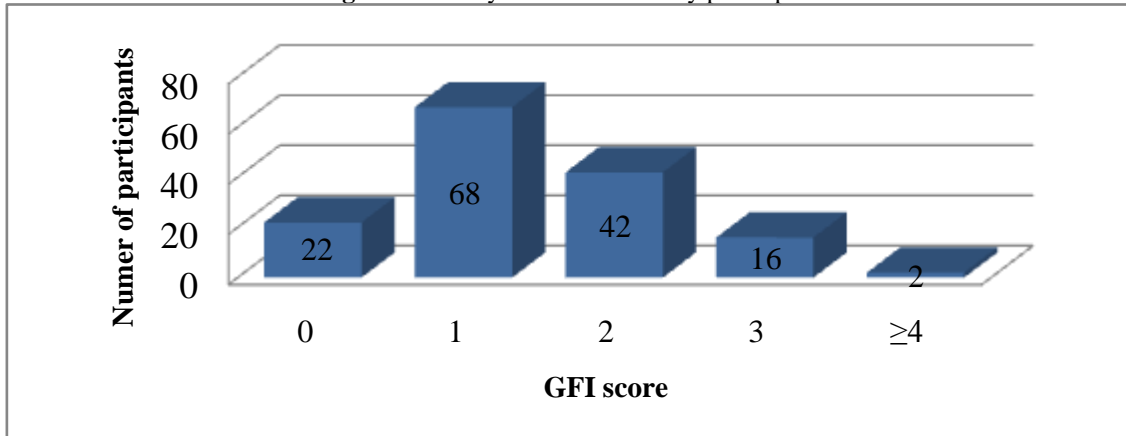
Frailty is a condition characterized by reduced physiological reserve and increased vulnerability to adverse outcomes after stress or events. A total of 150 participants were analyzed during the study among which 68 participants had a GFI score 1 they were restricted in doing physically strenuous activity, but ambulatory and

able to carry out light works. 42 participants had GFI score 2, were capable for self-care but unable to carry out any work. 16 participants had GFI score 3, were capable of only limited self-care and confined to bed or chair about <50 % of waking hours. Two participants were completely disabled (GFI Score ≥ 4), cannot carry on any self-care, totally confined to bed.

Table 2: Frailty status of the study participants:

GFI SCORE	NUMBER OF PATIENTS	INTERPRETATION
0	22	Normal activity without restriction
1	68	Restricted in physically strenuous activity but ambulatory and able to carry out light work
2	42	Ambulatory and capable for self-care, unable to carry out any work and about >50% of waking hours
3	16	Capable only limited self-care, confined to bed or chair and about <50 % of waking hours
≥ 4	2	Completely disabled cannot carry on any self-care, totally confined to bed.

Figure 1: Frailty status of the study participant



Prevalence of polypharmacy

Prescriptions from the study participants were thoroughly screened to check polypharmacy. Out of 150 prescriptions analyzed 111 prescriptions had more than five drugs i.e., 74% of the

participants were observed with polypharmacy. Only 26% of the participants (39) were receiving less than 5 drugs during their admission at hospital.

Table 3: Polypharmacy status among participants

TOTAL PATIENTS WITH 111(74%) POLYPHARMACY	
<5 drugs	39 (26%)
5-10 drugs	96 (64%)
11-15 drugs	15 (10%)

Distribution of pre-existing co-morbidities in study participants:

The study participants had various known preexisting co morbidities such as hypertension (HTN), diabetes mellitus (DM), ischemic heart

disease (IHD), liver disease, central nervous system disorders, chronic obstructive pulmonary disease and bronchial asthma. Most prevalent known medical condition observed in the participants were HTN and DM.

Table 4: Distribution of Preexisting co-morbidities in study participants

COMORBIDITY	TOTAL NUMBER
HTN	63
DM	54
IHD/CAD	17
COPD/BA	7

CKD/AKI	6
LIVER DISEASES	2
CNS DISORDERS	7
THYROID DISORDERS	8
CANCER	4
OTHER	20
NIL	57

Distribution of elderly patients with number of preexisting co morbid condition:

Out of the 150 participants, 93 patients were found to have more than 1 preexisting co morbidity. 34 of the patients had 2 preexisting co-

morbidities, 9 had 3 preexisting co morbidity, 6 of the patients had 4 preexisting co-morbidity and 5 of the participants had 5 preexisting co-morbidities. Out of the 150 participants 38% had no preexisting medical condition.

Table 5: Distribution of Elderly Patients with Number of Preexisting Co-morbidCondition

NUMBER OF KNOWN PREEXISTING CO-MORBIDITIES	NUMBER OF PATIENTS
0	57
1	39
2	34
3	9
4	6
5	5
Grand Total	150

Drug-drug interaction

Out of 150 prescriptions 120 prescriptions had at least one drug-drug interaction. Out of 120 prescriptions with DDIs, 1-2 Drug interactions were present in 49 prescriptions, 3-4 DDI's were

found in 31 prescriptions, 5-6 DDI's in 19 prescriptions and more than 7 DDI's were found in 21 prescriptions. In total 495 DDI's were detected among prescription of study participants.

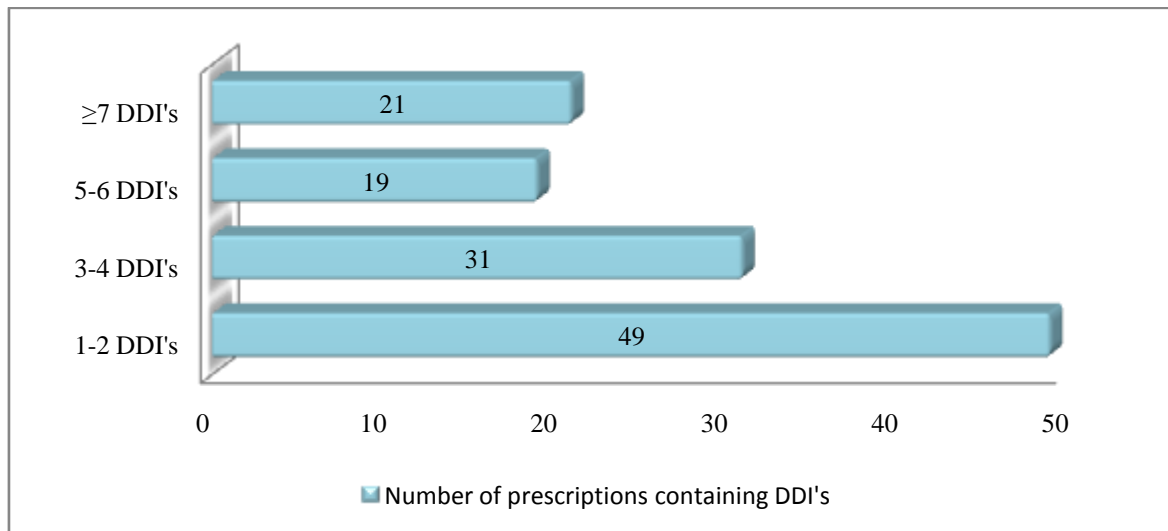


Figure 2: Number of prescriptions containing DDI's

Analysis of drug–drug interactions

Among the 495 DDIs detected there were 21 number of interactions that were classifiable as “X” and Table enlists the common DDIs encountered in “X” category where these

combinations have to be avoided. 58 number of interactions that were detected of “D” type where drug therapy has to be modified and 285 interactions were of category “C” where drug therapy needs to monitoring.

Table 6: Potential DDI according to severity and rating

CATEGORY	DESCRIPTION	NUMBER OF DRUG-DRUG INTERACTIONS
X	Avoid combination altogether	21
D	Consider therapy modification	58
C	Monitor given therapy	285

Drug-Drug interactions resolved

All the 495 interactions that were identified were brought to the notice of treating physicians, out of which only 137 DDI's were

resolved by either modifying the therapy or by avoiding the combination. 66.6% (14) of DDIs belonging to Category X were resolved by avoiding combination.

Table 7: Drug-Drug interactions resolved

CATEGORY	NO. OF DDIS IDENTIFIED	NO. OF DDIS RESOLVED
X	21	14
D	58	32
C	285	91

Beer’s criteria

Prevalence of PIM in geriatrics:

Prescriptions from the study participant were analysed by applying BEERS criteria. Among the 150 prescriptions evaluated, 50 prescriptions had at least one Potentially Inappropriate

medication (PIM). Among 50 prescriptions with PIMs 9 prescriptions had more than one potentially inappropriate medication. Application of Beers criteria to 150 prescriptions resulted in total 60 PIMs

Table 8: Prevalence of PIM’s in geriatrics

TOTAL MEDICATIONS	981
Mean number of medication (range)	6.54
Number of patients with at least one PIM	50
Total number of PIM	60

Frequency of PIM prescribed according to BEERS criteria

In the present study most frequently prescribed 3 classes of PIM were observed with NSAID’s (36.6 %), Opioids (31.6%) and α -1 adrenergic receptor antagonist (10%). Several other

drugs and drug classes account for the remaining PIM include Benzodiazepines (5%), Antihistamines (5%), Anticholinergic (3.3%), anti-parkinsonism agents (3.3%), Calcium channel blocker (1.6%), alpha2 adrenergic agonist (1.6%) and Sulfonylurea’s (1.6%).

Table 10: Frequency of PIM prescribed according to BEER’s criteria

DRUG CLASSES	PERCENTAGE
NSAID’s	36.6
Opioids	31.6
α -1 adrenergic receptor antagonist	10
Benzodiazepines	5
Antihistamine	5
Anti-cholinergic	3.3
Anti-Parkinson agents	3.3
Calcium channel blocker	1.6
Alpha-2 adrenergic agonist	1.6
Sulfonylureas	1.6

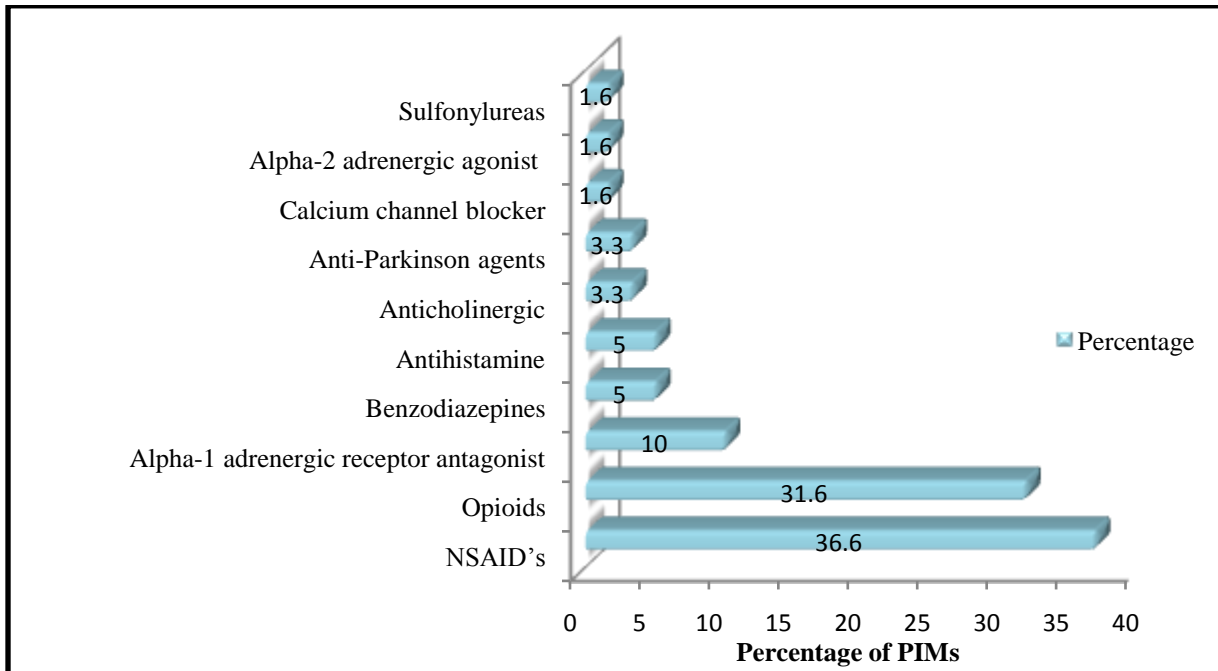


Figure 3: Frequency of PIM prescribed

BEERS criteria classification

PIMs identified were grouped into three categories according to 2019 Beers criteria.

Table 10: Classification of BEER's criteria

BEERS CLASSES	n%
Should be avoided	31.6% (19 drugs)
Should be avoid in certain conditions	16.6 % (10 drugs)
Use with caution	51.6 % (31 drugs)

Table 11: Potentially Inappropriate Medications according to Beer's criteria

NUMBER OF PATIENTS	DRUGS	TOTAL n%
	AVOID IN CERTAIN CONDITION	
1	Clonidine	1.6
8	Diclofenac	13.3
1	Etodolac	1.6
	AVOID	
2	Atropine	3.3
1	Nifedipine	1.6
6	Prazosin	10
2	Triprolidine	3.3

2	Trihexyphenidyl	3.3
2	Alprazolam	3.3
1	Ketorolac	1.6
1	Glibenclamide	1.6
1	Lorazepam	1.6
1	Hydroxyzine	1.6
USE WITH CAUTION		
19	Tramadol	31.6
12	Aspirin	20

Association between GFI and PIMs:

Table 12: Association between GFI and PIMs

GFI	BEERS CRITERIA			START CRITERIA			STOPP CRITERIA		
	PIM	NO PIM	p-value	PIM	NO PIM	p-value	PIM	NO PIM	p-value
0	11	11	0.0831	06	16	0.1747	00	22	0.0761
1	20	48		11	57		06	62	
2	19	23		10	32		08	34	
3	08	08		00	16		04	12	
>4	02	00		00	02		00	02	

In the current study there was no association found between frailty and potentially inappropriate medications at 0.05 level of significance.

Correlation between PIMs and number of drugs:

There was a significant positive correlation found between the number of PIMs using beers criteria (p value=0.000017), START criteria (p value= 0.0037) and STOPP criteria (p value=0.00001) and number of drugs prescribed in study participants.

Correlation between PIMs and number of co-morbidities:

The number of PIMs found using beers criteria was positively correlated with number of co-morbidities (p=0.0023), And similar correlation was also seen between PIMs found using START and STOPP criteria (p value <0.001).

V. DISCUSSION:

In terms of drug prescribing, the geriatric age group is considered to be a special risk group. Identifying the problem areas, suggesting interventions to improve the prescribing pattern, and reviewing current prescription patterns are all

part of rationalizing prescriptions for geriatric patients.⁶

The current study aimed to assess the proportion of geriatric patients receiving polypharmacy and inappropriate medication among hospitalized patients in various departments of a tertiary care hospital. The current study included nearly equivalent number of male and female geriatric patients. Majority of the patients belonged to the age group 65-70 years (56.6%), followed by age group 71 -80 years (34%), followed by age group 81-90 (8%), followed by patients above 91 years (1.3%) of age, similar to findings of other studies.^{6,9}

Frailty implies a reduction in reserve capacity, resulting in decreased mobility, unintended weight loss, increased morbidity risk, and depression and anxiety. Early detection of frailty in older adults is possible with Groningen Frailty Indicator (GFI) .Participants with a GFI score of 4 and above were considered frail. In the present study 45.3% (68) participants were restricted in doing physically strenuous activity but to carry out light work, 28% (42) participants were capable for self-care but unable to carry out any work, 10.6% (16) participants were capable of only limited self-care, confined to bed or chair, 1.3% (2) participants were completely disabled (GFI Score ≥

4), cannot carry on any self-care, totally confined to bed.

Current study results also reveal that there was no significant association between the frailty status of participants and the PIMs observed but similar study conducted in Saudi Arabia among geriatricin-patients at a tertiary care hospital observed association between PIMs and frailty.³

Number of co-morbidities is associated with growing age. Polypharmacy in geriatrics is a result of multiple co-morbidities. In the current study 111 patients were prescribed with > 5 drugs during their admission at the hospital. In our study 74% (111) of participants were on polypharmacy which is slightly lower than one of the studies conducted by Kartik Janardan Salwe et al., which showed 80% of polypharmacy in the patients admitted at a Tertiary Care Hospital in Pondicherry.⁹

Participants in the study had a comparatively high rate of potentially inappropriate medication use. The study identified 60 PIMs in 50 prescriptions of study participants as per Beers criteria. An Ethiopian study shows 40.3% Prevalence of PIM among evaluated prescriptions with Glibenclamide being the most common inappropriately prescribed drug.¹⁰

In a study conducted by Parveen Bansal et al., shows prevalence of PIM to be 61.9% as per 2019 beers criteria which is higher than prevalence seen in our study.¹¹ In the present study most frequently prescribed 3 classes of PIM were observed with NSAID's (36.6%), Opioids (31.6%) and α -1 adrenergic receptor antagonist (10%).

VI. CONCLUSION

Frailty, polypharmacy, and DDI are highly prevalent in the geriatric population, which has major healthcare outcomes. In the present study, an effort has been made to evaluate prescriptions for their inappropriateness by using BEER criteria, which should be strictly implemented in routine clinical practice. Further studies to assess the clinical implications of inappropriate prescribing have to be conducted and evaluated, which can be an indicator of scope for improvement in appropriate prescription. The discrepancies in geriatric prescribing may be reduced to an acceptable level by sensitizing prescribers to the aforementioned aspects of geriatric prescribing, encouraging treatment of the elderly as a unique risk population, and emphasising these aspects of prescribing in the educational curriculum.

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REFERENCE:

- [1]. Oliveira MG, Amorim WW, de Jesus SR, Heine JM, Coqueiro HL, Passos LC. A comparison of the Beers and STOPP criteria for identifying the use of potentially inappropriate medications among elderly patients in primary care. *J Eval Clin Pract.* 2015;21(2):320-5.
- [2]. Hajjar ER, Cafiero AC, Hanlon JT. Polypharmacy in elderly patients. *Am J GeriatrPharmacother.* 2007;5(4):345-51.
- [3]. Malik C, Khanna S, Jain Y, Jain R. Geriatric population in India: demography, vulnerabilities, and healthcare challenges. *J Fam Med Prim Care.* 2021;10(1):72-6.
- [4]. Gallagher PF, O'Connor MN, O'Mahony D. Prevention of potentially inappropriate prescribing for elderly patients: a randomized controlled trial using STOPP/START criteria. *Clin Pharmacol Ther.* 2011;89(6):845-54.
- [5]. Bushardt RL, Massey EB, Simpson TW, Ariail JC, Simpson KN. Polypharmacy: misleading, but manageable. *Clin Interv Aging.* 2008;3(2):383-9.
- [6]. By the 2019 American Geriatrics Society Beers Criteria® Update Expert Panel. The American Geriatrics Society beers criteria update expert P. American Geriatrics Society 2019 updated AGS beers criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc.* 2019;67(4):674-94.
- [7]. O'Mahony D, O'Sullivan D, Byrne S, O'Connor MN, Ryan C, Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people. version 2. *Age Ageing.* 2015;44(2):213-8.
- [8]. Salwe KJ, Kalyansundaram D, Bahurupi Y. A study on polypharmacy and potential drug-drug interactions among elderly patients admitted in department of medicine of a Tertiary Care Hospital in Puducherry. *J Clin Diagn Res.* 2016;10(2):FC06-10.
- [9]. Sultana R, Khabita. Evaluation of geriatric prescriptions applying beers criteria in a



- tertiary care hospital. Indian Res J Pharm Sci. 2019;6.
- [10]. Sharma R, Bansal P, Garg R, Ranjan R, Kumar R, Arora M. Prevalence of potentially inappropriate medication and its correlates in elderly hospitalized patients: A cross sectional study based on Beers criteria. J Family Community Med. 2020;27(3):200-7.
- [11]. Alsaad SM, AlEraj S, Alsaad AM, AlSaif HI, Bawazeer G. Potentially inappropriate medications among elderly with frailty in a Tertiary Care Academic Medical Centre in Saudi Arabia. Healthcare (Basel). 2022;10(8):1440.
- [12]. Nuñez-Montenegro A, Montiel-Luque A, Martin-Aurioles E, Garcia-Dillana F, Krag-Jiménez M, González-Correa JA. Evaluation of Inappropriate Prescribing in Patients Older than 65 Years in Primary Health Care. J Clin Med. 2019 ;8(3):305-10.
- [13]. Geeta Rathod, Nalini G K et al. Factors associated with Polypharmacy in geriatrics. International journal of Basic & Clinical Pharmacology. July 2017; 6(7): 1763-67.
- [14]. Endalifer BL, Wudu Y, Tamer AY (2022) Potentially Inappropriate Medication Use among Older Adults using the 2019 American Geriatrics Society Beer's Criteria. J Biomed Sci Vol.11 No.1
- [15]. Khandeparkar A, Rataboli PV. A study of harmful drug–drug interactions due to polypharmacy in hospitalized patients in Goa Medical College. PerspectClin Res 2017;8:180-6.