British Journal of Pharmaceutical and Medical Research Vol.03, Issue 01, Pg.825-832, January-February 2018

Available Online at http://www.bjpmr.org

BRITISH JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

Cross Ref DOI : https://doi.org/10.24942/bjpmr.2018.197 Volume 03, Issue 01, Jan.-February 2018

ISSN:2456-9836
ICV: 60.37

Research Article

Prevalence and Risk Factors of Polypharmacy and Potentially Inappropriate Medication in Older Adults Being Treated at a Rural Tertiary Care Hospital in South India

[1]Lilly Magna Willy N, [2]Jolly Varghese, [3]Anna Mathew

[1]MBBS Batch (2013), MOSC Medical College, Kolenchery, Ernakulam District. Kerala.
[2]Asst. Professor, Department of Pharmacology, MOSC Medical College, Kolenchery, Ernakulam District. Kerala.
[3]Professor, Department of Pharmacology, MOSC Medical College, Kolenchery, Ernakulam District. Kerala.

ARTICLE INFO

Article History:
Received on 12th January, 2018
Peer Reviewed on 29th January 2018
Revised on 15th February, 2018
Published on 24th February, 2018

Keywords:
Beers Criteria, medications, PIM, Older Adults, Polypharmacy

ABSTRACT

Background: Polypharmacy is the use of four or more concurrent daily prescription medications. Older adults are particularly susceptible not only because they are likely to be taking more medications due to chronic illnesses but also because ageing affects how the body handles these medications. This study was planned to assess the prevalence and pattern of polypharmacy and potentially inappropriate medications (PIMs) received by older adults.

Methodology: After receiving ethics committee approval, demographic and medication data was serially collected from the medical records of 391 patients treated at this rural tertiary care hospital.

Results: Out of 252 patients over 60 years of age, 88% were receiving 4-8 daily medications and 18% of them were prescribed over 8 medications. There was a significantly greater prevalence of polypharmacy in elderly diabetic and hypertensive patients. Of the 2357 medications prescribed to patients over the age of 60 years, 149 (6.3%) were PIMs. Of the 252 elderly patients who were enrolled in the study, 98 (38.8%) received at least one PIM.

Conclusion: A majority of older adults take more than four daily medications and nearly one fifth take more than eight daily medications. Over a third of older adults were prescribed at least one PIM such as long-term proton pump inhibitors, digoxin, amiodarone, dipyridamole or cilostazole. Though Beer's criteria have been available since 1987 and periodically updated they have not yet come into mainstream clinical use.

INTRODUCTION:

The process of ageing involves many changes in the biological, functional, psychological and social functioning which vary with genetic factors and result in the age-related vulnerability of the elderly. Often ageing comes with chronic illness, co-morbidity, disability and social isolation. These factors require the use of a number of medications and hence polypharmacy, the use of multiple concurrent medications, is a common problem encountered by clinicians caring for older adults. Many factors influence the efficacy, safety and success of drug therapy with older patients. These factors include not only the effects of aging on the pharmaco-kinetics and pharmaco-dynamics of medications but also drug interactions due to the greater number of medications that the older patient is prescribed.

Potentially inappropriate medication(PIMs)are medications that should generally be avoided in older persons because they are either ineffective or they pose unnecessarily high risk for older persons.

Polypharmacy is generally defined as the use of four or more prescription medications on a regular basis. Some studies have further classified polypharmacy into minor polypharmacy and major polypharmacy. Polypharmacy has also been defined as the concurrent use of multiple drugs, the use of more drugs than are clinically indicated, too many inappropriate drugs, two or more medications to treat the same condition or the use of two or more drugs of the same chemical class. [1] Therefore, even though the term polypharmacy has been used for decades, a clear definition is lacking. Multiple co-morbidities lead to the use of multiple drugs, and therefore a simple definition of poly pharmacy would be the administration of more medicines than are clinically indicated.[2]Treatment with two or three drugs may not result in medication problems, but when the number of drugs exceeds four, studies have shown a significant risk.[3] Most adverse drug events (ADE) are the result of drug interactions; the more drugs a patient takes, the higher the risk of interactions.[4] It has been estimated that the risk of drug interactions can increase from 6% in patients taking two medications, to 50 % with five medications, and 100% with up to 10 medications.[5]

The size of the elderly population is growing rapidly in India, from 5.6% of total population in 1961, it is projected to rise to 12.4% by year 2026. [6] An elderly patient is at risk for ADEs because the physiologic changes that occur with ageing make the body more sensitive to the effects of medications. [4] Many factors influence the efficacy, safety and success of drug therapy with older patients. Compared to the general population, a patient over 60 is more likely to have several chronic disorders, each requiring at least one medication. Elderly patients with more than one health condition are likely to receive care from several health care providers, each of whom may prescribe a different medication to treat the same symptoms. [7] New guidelines recommend the use of multiple classes of medication to treat and protect patients, such as a patient with coronary artery disease may receive a nitrate, an anti-platelet drug, a statin and an ACE inhibitor. [5]

Drug-disease interactions, in which a medication exacerbates a disease process, are also common among elderly patients, because of the prevalence of disease in this population. [8]. Anti-cholinergic drugs, for example, can exacerbate glaucoma, Alzheimer's disease, and benign prostatic hyperplasia. Consequences of polypharmacy include adverse drug effects, drug–drug interactions, disease–drug interactions, food–drug interactions, nutraceutical–drug interactions and prescribing cascade effect, where adverse effects are mistaken for symptoms of disease and more medications are given. [9] Nearly 50% of older adults take one or more medications that are not medically necessary. Research has clearly established a strong relationship between polypharmacy and negative clinical consequences and drug related problems. [10]

The search for PIMs was based on "The AGS 2015 Updated Beers Criteria for Potentially Inappropriate Medication (PIMs) was developed as a tool to assist healthcare providers in improving medication safety in older adults. [8] The AGS 2015 Beers criteria was updated from the 2012 Beers Criteria using a comprehensive, systematic review and grading of the evidence on drug-related problems and adverse drug events in older adults. The strategies to achieve this aim were to incorporate the new evidence available on currently listed PIMs and evidence from new medications or conditions not addressed in the 2012 update. A review of the Beers criteria applied to various health care settings, from community-dwelling seniors to frail nursing home patients, published in JAMA found that between one in four and one in seven older patients received at least one inappropriate medication. [11]

Physicians can initiate a variety of interventions such as reducing the number of medications taken, reducing the number of doses taken, increasing patient adherence, preventing ADRs, improving patient quality of life and decreasing facility and drug costs. [7, 12] In this cross-sectional study we aim to find the prevalence of polypharmacy and to use the AGS 2015 Beers Criteria to audit medications in patients coming to this rural tertiary

care hospital to improve medication safety in older adults. [8]

OBJECTIVES

1. To assess the prevalence of poly-pharmacy in older adult patients coming to this tertiary care center in South India.
2. To determine the pattern of polypharmacy in relation to various demographic factors and risk factors
3. To apply the AGS Beers criteria to assess the number of potentially inappropriate medications received in these patients

MATERIALS AND METHODS

This cross-sectional study is a patient-record based study of older adults coming to this tertiary care center. After obtaining Institutional review board and institutional ethics committee approval the patient records were serially reviewed to obtain the data.

Selection criteria: All records of patients over the age of 40 years attending the outpatient services of this tertiary care center were serially accessed. Patients receiving cancer chemotherapy and treatment for mycobacterial disease, HIV and AIDS were excluded.

Study definitions: Older adults in this study refer to patients over the age of 60 years.

Polypharmacy(PP) is defined as taking 4 or more medications concurrently. Minor poly-pharmacy will refer to patients receiving 4 – 8 drugs and major polypharmacy refers to those receiving over 8 drugs. [12]

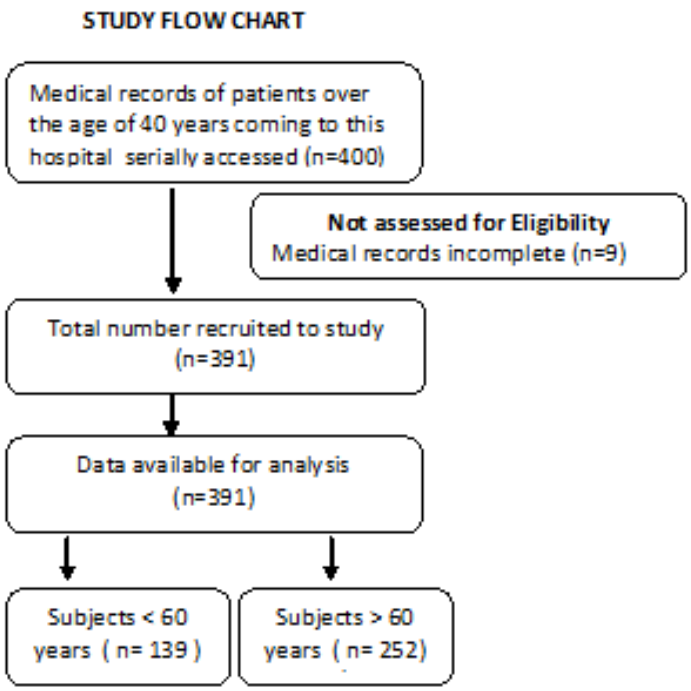
Drug interactions refer to modification of response to one drug by another when they are administered simultaneously .

Data collection: Demographic data and details of illness and medications of all patients fulfilling the selection criteria will be serially collected and entered in the study proforma. The AGS 2015 Beers Criteria will be applied to find potentially inappropriate medication. [8]

Sample Size: The Sample size was measured using nMaster Sample Size computer software [13] Using the prevalence of poly-pharmacy in the elderly of 4.2%, the sample size required for a confidence interval of 95% and a precision of 2% was found to be 386 records [14].

All data will be stored without personal identifiers and statistically analyzed using the Chi square test for categorical variables and the student-t test for continuous variables.

Figure 1. Study Flow Chart



RESULTS

Of the 400 charts accessed serially complete data was available for 391 patients. Of these 43(11%) were admitted to the ward while 348 (89%) were treated from the outpatient service. The baseline data is given in table 1.

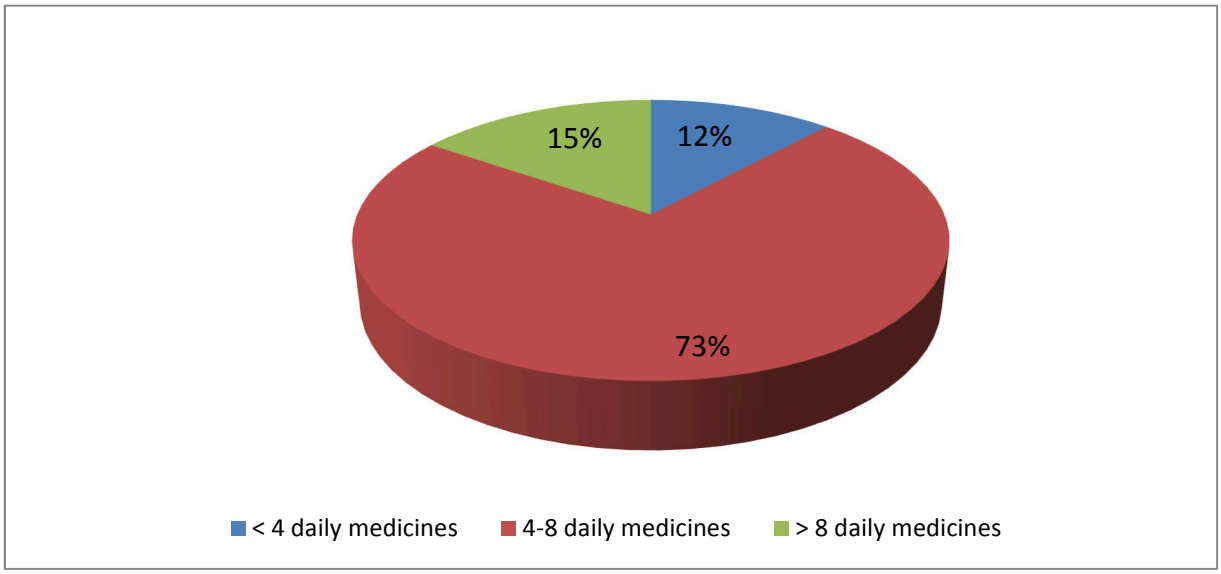
Table 1. Characteristics of the Patients Who Participated in the Study

n=391	Daily Medicines Less than 4/day	Daily Medicines More than 4/day	Total	p value
Gender				
Male	28 (12.8%)	191 (87.2%)	219(56%)	0.061
Female	34 (19.8%)	138 (80.3%)	172(44%)	
Total	62 (15.9%)	329(84.1%)	391 (100%)	
Age (years)				
<60 years	32 (23%)	107 (77%)	139 (35.5%)	<0.001
>61 years	30 (11.9%)	222 (88.1%)	252 (64.5%)	
Total	62(15.9%)	329 (84.1%)	391 (100%)	
Diabetes mellitus				
<60 years	3 (31.0%)	96 (69.0%)	139 (35.5%)	0.009
>61 years	118 (46.8%)	134 (53.2%)	252 (64.5%)	
Total	161 (41.2%)	230 (58.8%)	391 (100%)	
Hypertension	40 (28.8%)	99 (71.2%)	139 (35.5%)	
<60 years	137 (54.4%)	115 (45.6%)	252 (64.5%)	<0.001
>61 years	177 (45.2%)	214 (60.8%)	391 (100%)	
Total				
Hypertension + Diabetes				
<60 years	19 (13.7%)	120 (86.3%)	139 (35.5%)	<0.001
>61 years	80 (31.7%)	172 (68.3%)	252 64.5%)	
Total	99 (25.3%)	292 (54.7%)	391 (100%)	

Prevalence of Polypharmacy

Out of the total 391 records studied, 53 (13.5%) patients were receiving over 8 drugs per day, 62(15.9%) patients were receiving less than 4 daily drugs and the majority 276 (70.6%) of patients were receiving 4-7 drugs per day.

Figure 2. Number of Concurrent Medications in Older Adults



Among the 252 older adults over the age of 60 years, 222 (88%) patients were taking over 4 daily medicines whereas 107 (77%) of the 139 patients below 60 years were taking over 4 daily medications (p<.001).In patients > 60 years of age minor polypharmacy (4-8 daily medications) was found in 82% of subjects and major polypharmacy (over 8 daily medications) in 18% of these patients,.

Figure 3. Age Distribution of Major and Minor Polypharmacy

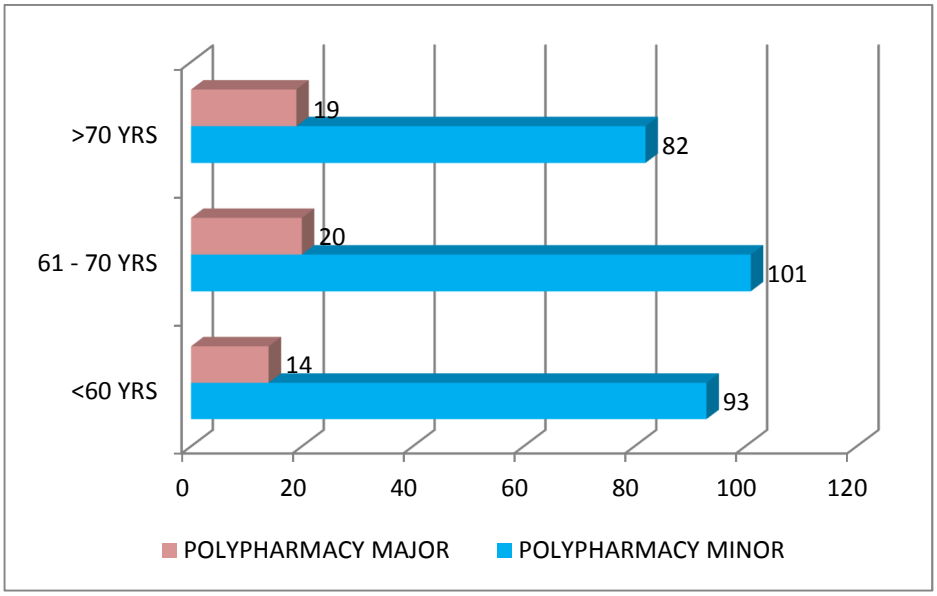


Figure 3. Legend Age Distribution of Polypharmacy

Out of the 391 patients studied polypharmacy was seen in 107 (76.9%) patients below 60, 121 (84%) patients between 61 and 70 and 101 (93.5%) patients over the age of 70 years (p=.001). Of the 101 patients over 70 years, 82 (81.2%)were receiving minor polypharmacy and 19 (18.8%) were receiving major polypharmacy.

Primary Department of Consultation

When the primary department of consultation of the patient was related to polypharmacy it was found that the patients attending the medicine department and medical specialties like cardiology, nephrology, dermatology etc. were more likely to have polypharmacy. This is under stable as therapeutic management in medicine primarily involves the use of drugs whereas it is more interventional in the surgical departments. The gynecology and obstetrics department were least likely to use polypharmacy.

The management of Diabetes mellitus (p=0.009) or hypertension (p<0.001) alone can also lead to poly-pharmacy in older patients. Another major risk factor that can lead to polypharmacy is cardio vascular disorders. Patients undergoing treatment for diabetes and hypertension concurrently were more likely to be receiving more than 8 daily medications (p=.001).

Potentially Inappropriate Medication

In our study we found that out of the 2357 medications prescribed to patients over the age of 60 years, 149 (6.3%) were potentially inappropriate medications. (Table 2)

Table 2. Potentially Inappropriate Medication in Older Adults Using Beers Criteria

Anticholinergics	
Chlorpheniramine, doxylamine, hydroxyzine, dicyclomine, hyoscyamine	4(1.5%)
Cardiovascular drugs	
Peripheral alpha1 blockers, central alpha agonists, disopyramide, digoxin, dronedarone, amiodarone, nifedipine and short acting dihydropyridines, dipyridamol.	21(8.3%)
Central nervous System drugs	
Tricyclic antidepressants, antipsychotics, barbiturates, benzodiazepines, non- benzodizepines like zolpidem	18(7.1%)

Gastrointestinal	
Metoclopramide, liquid paraffin, Proton pump inhibitors (PPI)	73 (28.9%)
Pain medications	
Aspirin, diclofenac, indomethacin, ketorolac, ibuprofen, mefenamic acid, naproxen, paracetamol, piracetam, meloxicam, nabumentone,	33(13.1%)

DISCUSSION

The present study has shown polypharmacy as a significant public health concern among older adults in India. The study has revealed diabetes and hypertension as the major risk factors that cause polypharmacy in India. Though we may not be able to reduce the number of medications this study raises awareness of the need for careful consideration and judicious prescription of medications. The findings of this study will be helpful for the researcher's healthcare providers and social workers to consider how the number of drugs can be judiciously reduced. Collaboration and working together by consultants while treating the patient, sharing treatment goals and plans and writing optimized appropriate prescriptions may help to reduce the number of drugs received by the patient.

In this study the majority of patients over 60 years of age are using more than four medications daily. The prevalence of polypharmacy in older adults was found to be 88 %. These findings support the evidences obtained in earlier studies. A similar study which was done at a tertiary care center in Puducherry in hospitalized patients also got a similar result. Salwe et al observed 6.3% potential inappropriate medicines in admitted patients and 4.9% in discharged elderly patients. [2] In our study we found out of 2357 medications prescribed, 149 (6.3%) were potentially inappropriate medications There is need to increase the awareness of clinicians about potentially inappropriate medication in older patients as listed in the Beers criteria. Harmonizing drug policy and regulatory measures with respect to potentially inappropriate medication use should be a major focus for the rational use of medications. Strategies such as withdrawing harmful medications, establish prescribing limits for elderly and approval of safer alternatives are some ways for safer use of medications in the elderly [14].

Institutional action to increase the physician's awareness of potentially inappropriate medication in older adults and the consequent dangerous drug interactions may help to curb irrational prescriptions and ensure medication safety in older adults. Many drugs that were once obtainable only with a prescription, such as proton pump inhibitors like omeprazole and anti-histaminic like loratidine, are now readily available over the counter, and their use is on the rise. In addition, complementary and alternative medicines, such as herbal therapies and neutraceuticals are becoming increasingly popular among patients, especially the elderly. [15]

A retrospective study was carried out in Bhopal district, Madhya Pradesh, India, in 2009 by collecting prescriptions of consultants at various levels of health care. The tendency for polypharmacy in these prescriptions was studied and analyzed under various heads in this survey. [10] They arrived at a similar conclusion that polypharmacy increases the risk of side effects and interactions. Moreover, it is a preventable problem. Available data suggests that polypharmacy is a widespread problem, and physician, clinical pharmacists and patients are all responsible. These risks can be minimized through identifying the prevalence of this potential problem in a high-risk population and by increasing awareness among patients and healthcare professionals. Physicians and clinical pharmacists have the potential to combat this problem through a variety of interventions such as reducing the number of medications taken, increasing patient adherence, preventing co-administration of drugs that interact, improving patient quality of life and decreasing facility and drug costs.[16]

Using the Beers criteria for potentially inappropriate medication (PIM) we found in our study that out of 252 elderly patients 98 (38.8%) had at least one PIM prescribed Another South Indian study by Harugeri A et al., observed PIMs in 22.1% patients while the US study on PIMS by Rothberg et al reported at least one PIM in 49% patients [15, 16]. One study from Bangalore by Manjaly et al reported 17.3% older patients received at least one PIM, and 7% received three while another study from Bangalore by Veena et al observed 21.69% of patients had a prescription with at least one PIM.[18, 19]

We found the commonest group of drugs prescribed were proton pump inhibitors. These are required to be avoided in older adults (Beer's criteria) because of the risk of *Clostridium difficile* infections, bone loss and risk of fractures in older adults. A good number of patients received anti-asthma medications with several receiving 3 or more anti-asthma medications without being given of

inhaled steroids. The other PIMs used were benzodiazepine, zolpidem, digoxin, cilostazole and amiodarone. In the pain medication list indomethacin, naproxen and aspirin were used. Insulin also comes under PIMs when it is prescribed in sliding scale and as this information was not available we could not comment on it. There were also some inappropriate drug combinations such as beta blockers and bronchodilators, and the use of dipyridamol in older adults. Prescribing greater numbers of medications may indicate the likelihood of exposure to PIMs. It may be too simplistic to comment on the number of medicines as in some instances, it may be appropriate to use more number of medications, however it is important to ensure there is no irrational use. The significance of this study lies in the fact that it highlights potentially inappropriate medication in older adults. Despite the existence of Beers criteria since 1987 and its periodic revision till the latest edition in 2015, these guidelines have not yet been incorporated into mainstream practice and this study hopes to increase awareness of the existence of these guidelines.

CONCLUSION

Eighty eight percent of older adults over the age of 60 years were prescribed more than 4 medications while 18 % of these received over 8 daily medications. There was a significant increase in polypharmacy in elderly diabetic and hypertensive patients. Over 38% of patients over the age of sixty years had at least one potentially inappropriate medication prescribed. Increasing awareness about Beers criteria for potentially inappropriate medication may help in reducing the use of these medications in older adults and in so doing decrease the risk of adverse events and provide medication safety.

ACKNOWLEDGEMENTS

We wish to acknowledge the Dean, Management and the departments of Pharmacology and Research of my Alma mater, MOSC Medical College, Kolencherry, for all the support and encouragement received for undertaking this study.

REFERENCES

1. Viktil KK, Blix HS, Moger TA, Reikvam A. Polypharmacy as commonly defined is an indicator of limited value in the assessment of drug-related problems. British J of Clini Pharmacol. 2007;63(2):187-95.
2. 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 Feb; 10(2): FC06–FC10. Published online 2016 Feb 1.
3. Bjerrum L, Søgaard J, Hallas J, Kragstrup J. Polypharmacy: correlations with sex, age and drug regimen. A prescription database study.Eur J Clin Pharmacol. 1998 May;54(3):197-202.
4. Wooten J, Galavis J, Polypharmacy: Keeping the Elderly Safe. Aug 2005 www.rnweb.com RN 68: 8 45-50.
5. Lin P. Drug interactions: A method to the madness. Perspectives in Cardiology, 20:10:20-24.
6. Situation Analysis of elderly in India. Central Statistics Office. Government of India.[2] 2011June2013].<http://mospi.nic.in/mospi_new/upload/elderly_in_india.pdf>.
7. Willlams CM. Using medications appropriately in older adults. Using medications appropriately in older adults. Am Fam Physician. 2002 Nov 15;66(10):1917-24.
8. The American Geriatrics Society 2015 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults by the American Geriatrics Society 2015 Beers Criteria Update Expert Panel. J Am Geriatr Soc 63:2227–2246, 2015.
9. Salazar JA, Poon I, Nair M. Clinical consequences of polypharmacy in elderly: Expect the unexpected, think the unthinkable. Expert Opinion on Drug Safety. 2007. 6:6: 695-704. DOI: 10.1517/14740338.6.6.695
10. Rambhade S, Chakarborty A, Shrivastava A, Patil UK, Rambhade A. A Survey on Polypharmacy and Use of Inappropriate Medications. Toxicology International Jan-Apr 2012 / Vol-19 / Issue-1.
11. Aparasu RR, Mort JR. Inappropriate prescribing for the elderly: Beers criteria-based review. Ann Pharmacother 2000;34:338-46.
12. Patterson SM, Hughes C, Kerse N, Cardwell CR, Bradley MC. Interventions to improve the appropriate use of polypharmacy for older people. Cochrane Database of Systematic Reviews2012, Issue 5. Art. No.:CD008165.DOI:10.1002/14651858.CD008165.pub2
13. Sample size measured using nMaster Sample Size Calculation software produced by Department of Biostatistics, Christian Medical College, Vellore 632 004. Tamil Nadu. India.
14. Dutta M, Prashad L. Prevalence and risk factors of polypharmacy among elderly in India: Evidence from SAGE Data. International Journal of Public Mental Health and Neurosciences ISSN:2394-4688. 2015; 2 (2): 137-140.
15. Fialová D, Topinková E, Gambassi G, et al. Potentially Inappropriate Medication Use Among Elderly Home

Care Patients in Europe.JAMA. 2005;293(11):1348-58.

16. Harugeri A, Joseph J, Parthasarathi G, Ramesh M, Guido S. Potentially inappropriate medication use in elderly patients: a study of prevalence and predictors in two teaching hospitals. J Postgrad Med. 2010 Jul-Sep;56(3):186-91. doi: 10.4103/0022-3859.68642.
17. Rothberg MB1, Pekow PS, Liu F, Korc-Grodzicki B, Brennan MJ, Bellantonio S, Heelon M, Lindenauer PK. Potentially inappropriate medication use in hospitalized elders. J Hosp Med. 2008 Mar;3(2):91-102. doi: 10.1002/jhm.290.
18. Manjaly SP, Francis G, Mathew B. Inappropriate Medication Use among Elderly Inpatients at a Teaching Hospital in South India. November 2016.JMSCR: 4:11. 14028-48.
19. Veena D.R, Padma L, Sapna Patil. Drug prescribing pattern in elderly patients in a teaching hospital. 2012. IOSR Journal of Dental and Medical Sciences (JDMS). 1:5. 39-42.

How to cite this article:
Lilly Magna Willy N, Jolly Varghese, Anna Mathew ***Prevalence and Risk Factors of Polypharmacy and Potentially Inappropriate Medication in Older Adults Being Treated at a Rural Tertiary Care Hospital in South India.*** **Br J Pharm Med Res , Vol.03, Issue 01, Pg.824-832, January - February 2018. ISSN:2456-9836 Cross Ref DOI : https://doi.org/10.24942/bjpmr.2018.197**

Source of Support: Nil **Conflict of Interest:** None declared