

AN ANALYSIS OF THE PREVALENCE OF POLYPHARMACY AMONG INPATIENTS OF A TERTIARY CARE HOSPITAL IN KERALA

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ABSTRACT

Objectives: The aim of the study was to estimate the prevalence of polypharmacy, identify the age groups commonly associated with polypharmacy, study the correlation between duration of hospital stay and polypharmacy, and identify the diseases commonly associated with polypharmacy

Methods: Record-based, prospective, and cross-sectional study among 370 inpatients of a tertiary care hospital in Kerala. Prescriptions containing ≥ 3 drugs were collected from inpatient medical records of patients with at least 3 days hospital stay. The number of drugs ≥ 5 was considered as polypharmacy in the present study.

Results: The prevalence of polypharmacy was 93% and average the number of drugs per prescription was 8.81 ± 3.097 . Average number of drugs per prescription was significantly high among patients >60 years. Percentage of prescriptions with polypharmacy among patients with duration of stay 3–5 days, 6–8 days, and ≥ 9 days was found to be 89.4, 98.6, and 100, respectively. There was a significant positive association between duration of hospital stay and percentage of prescriptions with polypharmacy as well as average number of drugs per prescription. Diseases or comorbidities most commonly associated with polypharmacy were hypertension, diabetes mellitus, cerebrovascular accidents, coronary artery disease, and dyslipidemia.

Conclusion: The prevalence of polypharmacy was high in the present study (93%) when compared to similar studies. Age >60 years was strongly associated with the prevalence of polypharmacy, but gender was not found to be factor. Duration of hospital stay was an important factor positively associated with percentage of prescriptions with polypharmacy as well as number of drugs per prescription.

Keywords: Inpatients, Polypharmacy, Prevalence, Prescription.

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INTRODUCTION

Polypharmacy is the use of several drugs together in the management of disease. This term often suggests indiscriminate, unscientific, or excessive prescription [1]. There is no consistent definition for polypharmacy in the literature and many authors define it as the use of five or six medications [2]. A simple definition of polypharmacy would be the administration of more medicines than clinically indicated [3]. Concomitant use of several drugs for a patient is often necessary for achieving therapeutic response or in cases when the patient is suffering from more than one disease. Patients may also take “over the counter” drugs in addition to prescription medications. Polypharmacy may be appropriate if all drugs in the regimen address recognized indications or inappropriate if more drugs prescribed than necessary [1].

When several medications are used simultaneously, there is an increased risk of drug-drug interactions (DDI) and adverse drug reactions (ADR) [4]. The number of concurrently used drugs is the most important predictor of these complications [5]. Studies from all over the globe have shown that a considerable part of hospital admissions is precipitated by drug-related problems and iatrogenic illness [6]. Polypharmacy may be responsible for unnecessary health expenditures directly due to the cost of medications and indirectly due to the increased number of hospitalizations caused by drug-related complications [7]. These factors eventually lead to increased patient costs, non-adherence to treatment, increased rate of patient morbidity, and morbidity [8,9]. Over the past 20–30 years, problems related to aging, multimorbidity, and polypharmacy have become a prominent issue in global healthcare. The consequences of polypharmacy and drug interactions have already been documented by many researchers particularly in Western countries [10,11].

Optimization of drug therapy by minimizing polypharmacy and preventing drug-related problems such as drug-drug interactions may save lives, enhance patient’s quality of life, and reduce health expenses. Interventions to reduce polypharmacy must address several issues such as the appropriateness of indication, drug-drug duplication in the same class of therapeutics, inappropriate and complex dosing, drug-drug interaction, drug disease interaction, drug food interaction, coordination of the medication between primary care provider and specialists, use of drug holidays, education of member regarding adverse drug effects, and other issues related to compliance [12]. In India, however, few studies have emphasized the role of polypharmacy and drug interactions and the most of the researches on this topic are centered among elderly. With this background, the aim of this study is to analyze the prevalence of polypharmacy and predictive factors associated with it like age, gender, duration of hospital stay, and comorbidities, among inpatients of a tertiary care hospital in Kerala. This study may help health-care professionals to optimize drug therapy by minimizing polypharmacy and associated complications such as DDI and adverse drug reactions.

Aim

The aim of the study was to analyze the prevalence and factors associated with polypharmacy among inpatients of a tertiary care hospital in Kerala.

Objectives

The objectives of the study are as follows:

1. To estimate the prevalence of polypharmacy
2. To identify the age groups commonly associated with polypharmacy
3. To study the correlation between duration of hospital stay and polypharmacy
4. To identify the diseases commonly associated with polypharmacy

METHODS

The prospective, record-based, and cross-sectional study was carried out among inpatients of a tertiary care hospital for 3 months (August–October 2020). Sample size was calculated as 370 using the formula, $n = z^2 pq/d^2$, with 5% margin of error on either side. Reference values for sample size calculation were obtained from the study done by Mohammed *et al.* among inpatients of tertiary care hospital [1]. In patients receiving ≥ 3 drugs with duration of hospital stay at least ≥ 3 days were included in the study. Patients with known drug allergies or history of drug abuse and emergency/intensive care unit patients were excluded from the study.

Patients were visited from inpatient locations by the investigator. Patients willing to take part were included in the study as per inclusion criteria. Written informed consent was obtained from each patient before accessing their medical records. Details required from each patient were name, unique identification number, age, sex, diagnosis, details of drugs with dose, route, frequency, and time of administration. Only one prescription was collected from each patient during hospital stay, 1 day before, or on the day of discharge. All the relevant details collected were documented in data collection form. Variables were coded and entered in Microsoft Excel worksheet.

The number of drugs ≥ 5 was considered as polypharmacy in the present study. Percentage of prescriptions with polypharmacy and average number of drugs per prescription was taken as indicators to calculate the prevalence of polypharmacy. Patients taking part in the study were categorized into different age groups (≤ 18 , 19–40, 41–60, 61–80, and >80 years). Average number of drugs prescribed in each age group was calculated. Comparison was done among patients ≥ 60 and >60 years as well as among males and females, regarding the average number of drugs per prescription. Duration of hospital stay in days was correlated with prevalence of polypharmacy as well as average number of drugs prescribed. The disease conditions most commonly associated with polypharmacy were identified. The number and percentage of prescriptions with each condition were calculated.

Ethical considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee (IEC No: 068/20). Written informed consent was taken from each participant and all the prevailing national and international ethical guidelines were followed.

Statistical analysis

Data were entered into Microsoft Excel sheet and were analyzed using Statistical Package for the Social Sciences (SPSS) version 16 software. Assistance from biostatistics expert was taken for data analysis. Descriptive statistics such as frequency, percentage, mean, and standard deviations were used for analysis. Chi-square test and independent sample *t* test were used to find the statistical significance. $P < 0.05$ was taken as statistically significant.

RESULTS

Prevalence of polypharmacy

Total 370 prescriptions were evaluated during the study. Total number of prescriptions with polypharmacy was 344 (93%). Total 3259 drugs were prescribed and the average number of drugs per prescription was 8.81 ± 3.097 . Results are tabulated in Table 1.

Table 1: Prevalence of polypharmacy

Parameters for Prevalence of Polypharmacy	Number (n)
Total number of prescriptions (n)	370
Number of prescriptions with polypharmacy (n)	344
Percentage of prescriptions with polypharmacy (%)	93.0
Total number of drugs (n)	3259
Average number of drugs per prescription	8.81 ± 3.097

Age-wise distribution

Patients were divided into age groups <18 , 19–40, 41–60, 61–80, and >80 . The frequency of polypharmacy in different age groups is detailed in Table 2. There was a significant difference between average number of drugs per prescription among patients ≤ 60 years and patients >60 years. Results are detailed in Table 3.

Gender-wise distribution

Out of 344 prescriptions with polypharmacy, 153 were from males and 191 were from females. There was no significant difference between males and females regarding the average number of drugs per prescription. Results are detailed in Table 4.

1. Relationship between duration of hospital stay and polypharmacy
Patients were categorized into three groups according to the duration of hospital stay. Percentage of prescriptions with polypharmacy in the groups 3–5 days, 6–8 days, and ≥ 9 days was found to be 89.4, 98.6, and 100, respectively. There was a significant positive association between duration of hospital stay and percentage of prescriptions with

Table 2: Age-wise distribution

Age group	Number of prescriptions (n)	Number of prescriptions with polypharmacy (n)	Percentage of prescription with polypharmacy (%)
<18	33	26	78.78
19–40	71	62	87.32
41–60	105	102	97.14
61–80	147	140	95.23
>80	14	14	100

Table 3: Age-wise comparison

Age group	Number of prescriptions with polypharmacy	Average number of drugs per prescription (n)	SD	t	p
<60	190	8.40	2.571	6.015	0.001
>60	154	10.18	2.897		

p value calculated by independent sample *t*-test, $p < 0.05$ considered as significant. SD: Standard deviation

Table 4: Gender-wise distribution

Gender	Number of prescription with polypharmacy (n)	Average number of drugs	SD	t	p
Male	153	9.27	2.812	0.425	0.671
Female	191	9.14	2.901		

p value calculated by independent sample *t*-test, $p < 0.05$ considered as significant. SD: Standard deviation

Table 5: Duration of hospital stay and polypharmacy

Duration of hospital stay	Number of prescriptions		Total, n (%)	χ^2	p
	Without polypharmacy, n (%)	With polypharmacy, n (%)			
3-5	25 (10.6)	211 (89.4)	236 (100)	12.789	0.002
6-8	1 (1.4)	69 (98.6)	70 (100)		
≥ 9	0 (0.0)	64 (100)	64 (100)		
Total	26 (7.0)	344 (93.0)	370 (100)		

Duration of hospital stay stated in days. p value calculated by independent sample *t*-test, $p < 0.05$ considered as significant

Table 6: Duration of hospital stay and average number of drugs

Duration of hospital stay	Number of drugs per prescription			Total, n (%)	χ^2	p
	<5, n (%)	5-9, n (%)	≥10, n (%)			
3-5	25 (10.6)	155 (65.7)	56 (23.7)	236 (100)	74.276	0.001
6-8	1 (1.4)	25 (35.7)	44 (62.9)	70 (100)		
≥9	0 (0.0)	17 (26.6)	47 (73.4)	64 (100)		
Total	26 (7.0)	197 (53.2)	147 (39.7)	370 (100)		

Duration of hospital stay stated in days. P value calculated by independent sample t-test, p<0.05 considered as significant

polypharmacy. Similarly, we could see a positive correlation between duration of hospital stay and number of drugs per prescription. Details are given in Tables 5-6.

Diseases associated with polypharmacy

Disease conditions commonly associated with polypharmacy included diabetes mellitus, hypertension, cerebrovascular accident, coronary artery disease, and dyslipidemia. The incidence of polypharmacy in these conditions is detailed in Table 7.

DISCUSSION

In the present study, 93% of prescriptions were found to have ≥5 drugs (polypharmacy). This is high when compared to the results from the study done by Mohammed *et al.* among South Indian population in 2012 [1]. In that study, 59.82% patients were receiving ≥5 drugs. In the study done by Rakesh *et al.*, 66.19% study subjects were on polypharmacy [13].

In the present study, the number of drugs per prescription ranged from 3 to 20 with an average of 8.81±3.097. In the study done by Salwe *et al.*, mean number of drugs prescribed at admission was 7.61±3.37 and 5.48±2.46 at discharge [14]. In the study done by Rakesh *et al.*, the number of drugs per prescription ranged from 1 to 10 and mean number of medications used by patients was 4.84±1.945 [13].

For the evaluation of age-wise distribution, the participants were divided into five age groups. The age group ≥80 had polypharmacy in all prescriptions (100%). This is followed by age groups 41-60 and 61-80 with 97.14 and 95.23% prevalence of polypharmacy, respectively. In the study by Rakesh *et al.*, proportion of polypharmacy was higher in 70-79 years age group (81.6%) [13]. In the study by Mohammed *et al.*, polypharmacy was more prevalent in the age group 19-60 years [1]. In the present study, there was a significant difference between average number of drugs per prescription among patients ≤60 years and patients >60 years. In the study by Rakesh *et al.*, the highest prevalence of polypharmacy was seen in 70-79 years age group. Rieckert *et al.* have demonstrated that being ≥85 years old was significantly associated with a lower risk for excessive polypharmacy (≥10 drugs). Rohini Gupta *et al.* have pointed out that polypharmacy was highest in the age group of 76-80 years. [15].

In the present study, there was no significant difference between males and females regarding the average number of drugs per prescription. Similar findings could be seen in the studies by Rieckert *et al.* and Rakesh *et al.* [10,13]. However, in a study done by Mohammed *et al.* and Slabaugh *et al.*, the proportion of polypharmacy was higher in the male gender [1,16].

We could see a significant positive association between duration of hospital stay and percentage of prescriptions with polypharmacy. Similarly, there was a positive correlation between duration of hospital stay and number of drugs per prescription. Similar findings could be seen in the study by Mohammed *et al.*, in which there was an increase in major polypharmacy (≥5 drugs) with increase in length of hospital stay [1]. In their study among elderly patients of a tertiary care hospital, Salwe *et al.* observed a positive correlation between number of days stayed in hospital with an increase in number of drugs. In that study, increase in 1 day stay by an elderly leads to an increase in number of drugs by a factor 0.296 during inpatient period and 0.095 at discharge [14].

Table 7: Diseases associated with polypharmacy

Disease	Number of prescriptions (n)	Number of prescriptions with polypharmacy	Percentage of prescriptions with polypharmacy
Diabetes mellitus	144	141	97.92
Hypertension	161	155	96.27
Cerebrovascular accident	45	44	97.78
Coronary artery disease	63	61	96.83
Dyslipidemia	72	71	98.61

Diseases or comorbidities most commonly associated with polypharmacy in the present study were hypertension, diabetes mellitus, cerebrovascular accidents, coronary artery disease, and dyslipidemia. More or less similar conditions could be seen associated with polypharmacy in different studies. In the study by Rieckert *et al.* and Rakesh *et al.* have demonstrated, hypertension, dyslipidemia, diabetes mellitus, osteoarthritis, ischemic heart disease, and central nervous system disorders were commonly associated conditions with polypharmacy [10,13]. In the study done by Rathod *et al.*, hypertension, diabetes mellitus, osteoarthritis, COPD, and gastritis were the most common conditions associated with polypharmacy [17]. The study by Dutta and Prashad has revealed that bad self-rated health, diabetes, depression, and hypertension are the major risk factors of polypharmacy among elderly in India [18].

Recommendations

Potentially inappropriate medicines in the prescriptions may be analyzed. Interventional studies are needed to evaluate the clinical significance of polypharmacy and whether optimizing therapy by minimizing the number of drugs can reduce drug-related morbidity or mortality.

CONCLUSION

This study threw light on the prevalence polypharmacy of among inpatients of a tertiary care hospital in Kerala. The prevalence of polypharmacy was high in the present study (93%) when compared to similar studies. Age >60 years was strongly associated with the prevalence of polypharmacy, but gender was not found to be factor. Duration of hospital stay was an important factor positively associated with percentage of prescriptions with polypharmacy as well as number of drugs per prescription. Disease conditions commonly associated with polypharmacy included diabetes mellitus, hypertension, cerebrovascular accident, coronary artery disease, and dyslipidemia.

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AUTHOR'S CONTRIBUTION

Dr. JihanaShahjahan: Protocol preparation, data collection, data analysis, manuscript preparation, editing, and review. Dr. Abdul Aslam

P: Protocol preparation, manuscript preparation, editing, review, and correspondence. Dr. Jobin Joy: Data collection, data analysis, and manuscript preparation. Dr. Minu Baby: Protocol preparation, data collection, data analysis, and manuscript preparation.

CONFLICTS OF INTEREST

Nil by authors.

REFERENCES

- Mohammed SS, Sreenath MK, Vishnu VG, Jose F, Siraj ST, Anand VP. The prevalence of polypharmacy in South Indian patients: A pharmacoepidemiological approach. *IJPP* 2012;5:40-4.
- Good CB. Polypharmacy in elderly patients with diabetes. *Diabetes Spec* 2002;15:240-8. doi: 10.2337/diaspect.15.4.240
- Hajjar ER, Hanlon JT, Sloane RJ, Lindblad CI, Pieper CF, Ruby CM, et al. Unnecessary drug use in frail older people at hospital discharge. *J Am Geriatr Soc* 2005;53:1518-23. doi: 10.1111/j.1532-5415.2005.53523.x, PMID 16137281
- Kurfes JF, Dotson RL. Drug interactions in the elderly. *J Fam Pract* 1987;25:477-88. PMID 3681207
- Flaherty JH, Perry HM 3rd, Lynchard GS, Morley JE. Polypharmacy and hospitalization among older home care patients. *J Gerontol A Biol Sci Med Sci* 2000;55:M554-9. doi: 10.1093/gerona/55.10.m554, PMID 11034227
- Reus VI. Rational polypharmacy in the treatment of mood disorders. *Ann Clin Psychiatry* 1993;5:91-100. doi: 10.3109/10401239309148969, PMID 8102302
- Nolan PE Jr., Marcus FI. Cardiovascular drug use in the elderly. *Am J Geriatr Cardiol* 2000;9:127-9. doi: 10.1111/j.1076-7460.2000.80021.x, PMID 11416550
- Incalzi RA, Gemma A, Capparella O, Terranova L, Porcedda P, Tresalti E, et al. Predicting mortality and length of stay of geriatric patients in an acute care general hospital. *J Gerontol* 1992;47:M35-9. doi: 10.1093/geronj/47.2.m35, PMID 1538063
- Linjakumpu T, Hartikainen S, Klaukka T, Veijola J, Kivelä SL, Isoaho R. Use of medications and polypharmacy are increasing among the elderly. *J Clin Epidemiol* 2002;55:809-17. doi: 10.1016/s0895-4356(02)00411-0, PMID 12384196
- Rieckert A, Trampisch US, Klaaßen-Mielke R, Drewelow E, Esmail A, Johansson T, et al. Polypharmacy in older patients with chronic diseases: A cross-sectional analysis of factors associated with excessive polypharmacy. *BMC Fam Pract* 2018;19:113. doi: 10.1186/s12875-018-0795-5, PMID 30021528
- Halvorsen KH, Selbaek G, Ruths S. Trends in potentially inappropriate medication prescribing to nursing home patients: Comparison of three cross-sectional studies. *Pharmacoepidemiol Drug Saf* 2017;26:192-200. doi: 10.1002/pds.4142, PMID 27935150
- Rollason V, Vogt N. Reduction of polypharmacy in the elderly: A systematic review of the role of the pharmacist. *Drugs Aging* 2003;20:817-32. doi: 10.2165/00002512-200320110-00003, PMID 12964888
- Rakesh KB, Chowta MN, Shenoy AK, Shastry R, Pai SB. Evaluation of polypharmacy and appropriateness of prescription in geriatric patients: A cross-sectional study at a tertiary care hospital. *Indian J Pharmacol* 2017;49:16-20. doi: 10.4103/0253-7613.201036, PMID 28458417
- 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:FC06-10. doi: 10.7860/JCDR/2016/16284.7273, PMID 27042480
- Gupta R, Malhotra A, Malhotra P. A study on polypharmacy among elderly medicine in-patients of a tertiary care teaching hospital of North India. *Natl J Physiol Pharm Pharmacol* 2018;8:1297-301. doi: 10.5455/njppp.2018.8.0518424052018
- Slabaugh SL, Maio V, Templin M, Abouzaid S. Prevalence and risk of polypharmacy among the elderly in an outpatient setting: A retrospective cohort study in the Emilia-Romagna region, Italy. *Drugs Aging* 2010;27:1019-28. doi: 10.2165/11584990-000000000-00000, PMID 21087071
- Rathod G, Nalini GK, Nagaral JV, Sahana GN, Deepak P, Prema M, et al. Factors associated with polypharmacy in geriatrics. *Intl J Basic Clin Pharmacol* 2017;6:1763-7.
- Dutta M, Prashad L. Prevalence and risk factors of polypharmacy among elderly in India: Evidence from SAGE Data. *Int J Public Ment Health Neurosci* 2015;2:2394-4668.