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A prospective surveillance study on the prevalence and influential determinants of polypharmacy in hospitalized geriatric patients

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ABSTRACT

A prospective surveillance study on the prevalence and influential determinants of polypharmacy in hospitalized geriatric patients was conducted in a tertiary care referral hospital in south Malabar region of Kerala. This study was conducted in the major seven departments of the hospital including General medicine, Cardiology, Nephrology, Neurology, Orthopaedic, Pulmonology and Gastroenterology departments. The patients were categorized based on specific criteria for the purpose of assessing the correlation between the prevalence of polypharmacy and these influential determinants. Statistical analysis was carried out using SPS version 17.0. P value < 0.05 was considered statistically significant. Chi-square test, was employed for assessing the degree of association between the three influential determinants of polypharmacy and its' prevalence. The prevalence of polypharmacy was found to be highest in Cardiology department followed by Orthopaedic, Nephrology, Neurology, Pulmonology. General medicine and the least in Gastroenterology department. The Influential determinants of polypharmacy were identified as: The Influential determinants of polypharmacy were identified as: Age, Co morbidities and Length of Hospitalization.

Key words: Polypharmacy, prevalence, influential determinants.

INTRODUCTION

There is no single agreed definition of the term 'polypharmacy'[1].Polypharmacy is the use of multiple medications by the patient, more than five drugs[2]Polypharmacy has been identified as the principal determinant of potentially inappropriate prescribing (PIP) in older people.[3] The term PIP encompasses overprescribing, misprescribing and under prescribing.[4]Drug use is a complex subject involving the prescriber, the patient and the dispenser[5]. Despite the complexity of drug use, a number of indicators have been developed, standardized and evaluated by the WHO[6,7]. These indicators are used to measure drug use in out-patient facilities and provide measures of the optimal use of resources in the facilities as well as help in correcting deviations from the expected standards and in planning[6,7,8].

The present study aims to evaluate the prevalence of polypharmacy in a tertiary hospital in south Malabar region of Kerala state of India, and also to assess its influential determinants.

MATERIALS AND METHODS

Study area: This study titled "A prospective surveillance study on the prevalence and types of polypharmacy in hospitalized geriatric patients" was conducted in KIMS Al Shifa Hospital, Perinthalmanna, Malappuram district. It is one of the largest tertiary care teaching hospitals in south Malabar region of Kerala.

Study population: The study population included hospitalized patients aged > 60 years.

Departments selected for the study: This study was conducted in the major 7 departments of the hospital including General medicine, Cardiology, Nephrology, Neurology, Orthopaedic, Pulmonology and Gastroenterology departments. Other departments were not focused since the numbers of geriatric inpatients in these departments were relatively low.

Study design: A prospective surveillance study was undertaken which involves the evaluation of geriatric inpatients' treatment plan to detect and determine the prevalence and types of polypharmacy.

Duration of study: This study was carried out for a period of 5 months, from August to December 2015.

Ethical consideration: Ethical approval for this study was obtained from the Ethics committee of KIMS Al Shifa Hospital.

Study criteria:
Inclusion criteria:
- Hospitalized patients aged > 60 years (Geriatric patients).
- Only inpatients.
- 7 major departments including Cardiology, General medicine, Gastroenterology, Nephrology, Neurology, Orthopaedic and Pulmonology departments.
- Patients of both genders were included.
- Patients who were taking both oral and parentral drugs.

Exclusion criteria:
- Patients aged below 60 years.
- Patients admitted in ICUs and MICUs.
- Patients admitted in departments like Dentistry, Dermatology, Opthalmology, Psychiatry, General surgery, Microvascular surgery, Neurosurgery, Endocrinology, and Urology.
- Drugs like Intra venous fluids, crystalloids colloids, topical and rectal formulations were excluded.

Sources of data:
- Patient treatment charts
- Patient admission (re-admission) records
- Medical notes
- Observation charts
- Laboratory data
- Personal interview with patients or their bystanders
- Personal interview with clinicians

Instruments for data collection: Relevant and articulate data of eligible patients were obtained and recorded using a data collection form titled "Polypharmacy surveillance form for hospitalized geriatric patients". The documentation involved demographic details of the patients, reason for admission, provisional diagnosis, multiple diagnosis (if any), past medical and medication history, family and social history, length of hospitalization and the drug treatment chart (Name of the drug, dose, dosage forms, route and frequency of administration).

Study protocol: The study mainly included those hospitalized elderly patients aged > 60 years admitted to various departments of hospital except ICUs, MICUs, Dentistry, Urology, Surgery, Endocrinology and ENT departments. The demographic profile of the patients, family and social history, past medical and medication histories were obtained from the relevant sources mentioned above and through direct patient interviews. The patients' treatment charts were then reviewed for checking whether they have been subjected to polypharmacy and if so, to identify the category of polypharmacy, i.e. appropriate/ inappropriate and high level polypharmacy. The patients were then categorized based on their age, length of hospital stay and multiple diagnoses, which were being taken as the influential determinants of polypharmacy, for the purpose of assessing the correlation between the prevalence of polypharmacy and these influential determinants. The study has been conducted for a period of 5 months

Statistical analysis: Statistical analysis was carried out using SPS version 17.0. P value < 0.05 was considered statistically significant. Chi-square test, a non parametric test, was employed for assessing the degree of association between the three influential determinants of polypharmacy and its' prevalence, performed for the degree of freedom (df) at 2 and level of significance at 5 (0.05). The calculated value of Pearson Chi-square for each parameter was measured and then compared with the table value of the same for detecting the presence of

association. If the calculated value of Pearson Chi-square of these parameters exceed the corresponding table value, the alternate hypothesis (H_1)stating the presence of association is accepted. If not, it signifies that no association exists between these two parameters, i.e. Null hypothesis (H_0) is accepted.

RESULTS AND DISCUSSION

A total of 145 geriatric patients' medication charts were assessed for identifying and evaluating polypharmacy as a part of Phase 1 study which extended for 5 months.

Out of 145 patients, 85 patients were males (58.6%) and 60 were females (41.4%). A total of 94 patients (64.8%) were subjected to polypharmacy, among which 51 patients (35.2%) were subjected to *appropriate polypharmacy** and 43 patients (29.6%) were subjected to *inappropriate polypharmacy**. *High level Polypharmacy** was found in 34 (36.1%) patients. The remaining 51 patients (35.2%) were deprived of polypharmacy.

Table 1: Prevalence of polypharmacy in patients

Total number of patients	Males	Females	Patients with non polypharmacy	Patients with appropriate polypharmacy	Patients with inappropriate polypharmacy	Patients with high level polypharmacy
145	85 (58.6%)	60 (41.4%)	51 (35.2%)	51 (35.2%)	43 (29.6%)	34/94 (36.1%)

Table 2: Prevalence of polypharmacy in each department

Department	Total patients	Non polypharmacy	Appropriate polypharmacy	Inappropriate polypharmacy	High level polypharmacy
Cardiology	7	0 (0%)	5 (71.4%)	2 (28.6%)	2/7 (28.6%)
Nephrology	20	4 (20.0%)	7 (35.0%)	9 (45.0%)	6/16 (37.5%)
Orthopaedic	10	1 (10.0%)	2 (20.0%)	7 (70.0%)	2/9 (22.2%)
Neurology	14	3 (21.5%)	6 (42.8%)	5 (35.7%)	4/11 (36.3%)
Pulmonology	16	7 (43.8%)	6 (37.5%)	3 (18.7%)	1/9 (11.1%)
General medicine	64	29 (45.4%)	18 (28.1%)	17 (26.5%)	16/35 (45.7%)
Gastroenterology	14	7 (50.0%)	7 (50.0%)	0 (0%)	3/7 (42.8%)
Total	145	51 (35.2%)	51 (35.2%)	43 (29.6%)	34/94 (36.1%)

**Appropriate polypharmacy: Concurrent use of 5-9 drugs with indication.*
**Inappropriate polypharmacy: Concurrent use of 5-9 drugs without indication.*
**High level polypharmacy: Concurrent use of > 10 drugs.*

The prevalence of polypharmacy was found to be highest in Cardiology department (100%), followed by Orthopaedic (90.0%), Nephrology (80.0%), Neurology (78.5%), Pulmonology (56.2%), General medicine (54.6%) and the least in Gastroenterology department (50.0%).

The prevalence of High level polypharmacy was found to be highest in General medicine department (45.7%) followed by Gastroenterology (42.8%), Nephrology (37.5%), Neurology (36.3%), Cardiology (28.6%), Orthopaedic (22.2%) and the least in Pulmonology department (11.1%).

Influential determinants of polypharmacy:
The Influential determinants of polypharmacy were identified as: Age, Co morbidities and Length of Hospitalization.

1.) Age: Patients in the age group of 60-70 years constituted 79 in number, patients within 71-80 age range were 44 in number and the remaining 22 patients were > 81 years old.

Table 3: Cross tabulation of patients with different age range and patients with polypharmacy

Age in years	Patients with appropriate polypharmacy	Patients with inappropriate polypharmacy	Patients with non polypharmacy	Total
Patients with 60-70 years	28 (54.9%)	19 (44.1%)	32 (62.7%)	79 (54.4%)
Patients with 71-80 years	14 (27.4%)	17 (39.5%)	13 (25.4%)	44 (30.3%)
Patients with ≥81 years	9 (17.7%)	7 (16.4%)	6 (11.9%)	22 (15.3%)
Total	51 (100.0%)	43 (100.0%)	51 (100.0%)	145 (100.0%)

Chi-square tests

	Calculated value	Table value	Degree of freedom (df)	Asymp. Sig (2 sided)
Pearson Chi square value	6.56	5.991	2	0.002

Since the calculated value of Pearson chi-square (6.56) for the degree of freedom (df) 2 at the level of significance 5% exceeds the table value of Pearson chi-square (5.991), it is confirmed that an association exists between the age and prevalence of polypharmacy. More precisely, as the age increases, the incidence of polypharmacy also increases proportionally.

Table 4: Cross tabulation of patients with different age range and patients with high level polypharmacy

Age in years	Patients with high level polypharmacy	Patients without high level polypharmacy	Total
Patients with 60-70 years	6 (17.6%)	73 (65.7%)	79 (54.4%)
Patients with 71-80 years	12 (35.2%)	32 (28.8%)	44 (30.3%)
Patients with ≥81 years	16 (47.2%)	6 (5.5%)	22 (15.3%)
Total	34 (100.0%)	111 (100.0%)	145 (100.0%)

Chi-square tests

	Calculated value	Table value	Degree of freedom (df)	Asymp. Sig (2 sided)
Pearson Chi square value	7.85	5.991	2	0.002

Since the calculated value of Pearson chi-square (7.85) for the degree of freedom (df) 2 at the level of significance 5% exceeds the corresponding table value of Pearson chi-square (5.991), it is confirmed that an association exists between the age and prevalence of high level polypharmacy. Hence, as the age increases, the incidence of high level polypharmacy also increases.

Table 5: Cross tabulation of patients with co morbidities and patients with polypharmacy

Patients with co morbidities	Patients with appropriate polypharmacy	Patients with inappropriate polypharmacy	Patients with non polypharmacy	Total
Patients with 0 co morbidities	6 (11.8%)	5 (11.6%)	7 (13.7%)	18 (12.4%)
Patients with 1/2 co morbidities	31 (60.8%)	24 (55.8%)	34 (66.7%)	89 (61.4%)
Patients with ≥3 co morbidities	14 (27.5%)	14 (32.6%)	10 (19.6%)	38 (26.2%)
Total	51 (100.0%)	43 (100.0%)	51 (100.0%)	145 (100.0%)

Chi-square tests

	Calculated value	Table value	Degree of freedom (df)	Asymp. Sig (2 sided)
Pearson Chi square value	6.38	5.991	2	0.002

Since the calculated value of Pearson chi-square (6.38) for the degree of freedom (df) 2 at the level of significance 5% exceeds the corresponding table value of Pearson chi-square (5.991), it is confirmed that an association exists between the co morbidities and prevalence of polypharmacy. More precisely, as the number of co morbidities increase, the incidence of polypharmacy also increases.

Table 6: Cross tabulation of patients with co morbidities and patients with high level polypharmacy

Patients with co morbidities	Patients with high level polypharmacy	Patients without high level polypharmacy	Total
Patients with 0 co morbidities	3 (8.8%)	15 (13.5%)	18 (12.4%)
Patients with 1/2 co morbidities	19 (55.9%)	70 (63.1%)	89 (61.4%)
Patients with ≥3 co morbidities	12 (35.3%)	26 (23.4%)	38 (26.2%)
Total	34 (100.0%)	111 (100.0%)	145 (100.0%)

Chi-square tests

	Calculated value	Table value	Degree of freedom (df)	Asymp. Sig (2 sided)
Pearson Chi square value	12.192	5.991	2	0.002

Since the calculated value of Pearson chi-square (12.192) for the degree of freedom (df) 2 at the level of significance 5% exceeds the table value of Pearson chi-square (5.991), it is confirmed that an association exists between the co morbidities and prevalence of high level polypharmacy. Hence, as the number of co morbidities increase, the incidence of high level polypharmacy also increases.

Table 7: Cross tabulation of length of hospitalization and patients with polypharmacy

Length of hospitalization	Patients with appropriate polypharmacy	Patients with inappropriate polypharmacy	Patients with non polypharmacy	Total
1-4 days	13 (25.5%)	4 (9.3%)	20 (39.2%)	37 (25.5%)
5-9 days	30 (58.8%)	24 (55.8%)	28 (54.9%)	82 (56.6%)
≥ 10 days	8 (15.7%)	15 (34.9%)	3 (5.9%)	26 (17.9%)
Total	51 (100.0%)	43 (100.0%)	51 (100.0%)	145 (100.0%)

Chi-square tests

	Calculated value	Table value	Degree of freedom (df)	Asymp. Sig (2 sided)
Pearson Chi square value	19.420	5.991	2	0.001

Since the calculated value of Pearson chi-square (19.420) for the degree of freedom (df) 2 at the level of significance 5% exceeds the table value of Pearson chi-square (5.991), it is confirmed that an association exists between the length of hospitalization and prevalence of polypharmacy. Hence, as the length of hospitalization increases, the incidence of polypharmacy also increases.

Table 8: Cross tabulation of length of hospitalization and patients with high level polypharmacy

Length of hospitalization	Patients with high level polypharmacy	Patients without high level polypharmacy	Total
1-4 days	3 (8.8%)	34 (30.6%)	37 (25.5%)
5-9 days	21 (61.8%)	61 (55.0%)	82 (56.6%)
≥ 10 days	10 (29.4%)	16 (14.4%)	26 (17.9%)
Total	34 (100.0%)	111 (100.0%)	145 (100.0%)

Chi-square tests

	Calculated value	Table value	Degree of freedom (df)	Asymp. Sig (2 sided)
Pearson Chi square value	8.389	5.991	2	0.016

Since the calculated value of Pearson chi-square (8.389) for the degree of freedom (df) 2 at the level of significance 5% exceeds the table value of Pearson chi-square (5.991), it is confirmed that an association exists between the length of hospitalization and prevalence of high level polypharmacy. Hence, as the length of hospitalization increases, the incidence of high level polypharmacy also increases.

Most common Off-label prescribed drugs:
The most common *Off-Label** prescribed drugs are:

Pantoprazole: 94/128 (73.4%)
Cefoperazone + Sulbactum : 50/86 (58.1%)
Atorvastatin : 28/67 (41.7%)

The reason for prescribing PPIs (Proton pump inhibitors like Pantoprazole, Rabeprazoleetc) as off-label was to combat the common gastro intestinal disorders/ side effects induced by other drugs.

Moreover, systemic antibiotics (Cefoperazone+Sulbactum) were used as a prophylactic in most cases, despite of performing a culture and sensitivity tests.

Atorvastatin was mostly prescribed to cardiology patients, though a majority of patients were not having hypercholstrolemia, since it is always recommended as a part of treatment guidelines.

Table 9: Most common off-label prescribed drugs and percentage of off-label prescriptions

Most common Off-label prescribed drugs	Total number of patients being prescribed with the drug	Number of patients prescribed with Off-label indication	% of Off-label prescriptions
Pantoprazole	128	94	73.4%
Cefoperazone+sulbactum	86	50	58.1%
Atorvastatin	67	28	41.7%

***Off-Label** - Drug use without indication

Table 8: Percentage of most common off label prescribed drugs in each department:

Department	% of Off-label prescriptions
General medicine	Pantoprazole- 77.4% Cefoperazone+sulbactum- 69.6% Atorvastatin- 53.1%
Orthopaedic	Pantoprazole- 75% Cefoperazone+sulbactum- 76.9% Atorvastatin- 50%
Pulmonology	Pantoprazole- 66.6% Cefoperazone+sulbactum- 35.7% Atorvastatin- 33.3%
Neurology	Pantoprazole- 84.6% Cefoperazone+sulbactum- 33.3% Atorvastatin- 14.2%
Gastroenterology	Pantoprazole- 22.2% Cefoperazone+sulbactum- 60% Atorvastatin- 25%
Nephrology	Pantoprazole- 75% Cefoperazone+sulbactum- 54.5% Atorvastatin- 10%
Cardiology	Pantoprazole- 85.7% Cefoperazone+sulbactum- 25% Atorvastatin- 71.4%

CONCLUSION

The influential determinants of polypharmacy were identified as Age, Co morbidities and Length of hospitalization, and their association with the rate of polypharmacy was assessed using Chi-square statistical method. The prevalence of polypharmacy and high level polypharmacy suggest that there is a large scope to assess the consequences of these practices in the hospitalized elderly population in India. Interventions to reduce polypharmacy and high level polypharmacy during hospital stays should focus on patients who have co morbidities, increasing age and hospitalized for ≥ 10 days.

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