# The Prevalence of Polypharmacy in South Indian Patients: A Pharmacoepidemiological Approach.

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The study conducted assessed the prevalence of polypharmacy and identified the individuals particularly at risk of polypharmacy.Data collection was based on the prescriptions collected from patient's hospital records and case sheets. The collected prescriptions were scrutinized for polypharmacy and were categorized as minor polypharmacy - concurrent use of 2 to 4 drugs; and major polypharmacy – concurrent use of five or more drugs. Out of 1003 prescriptions 630 prescriptions were found to be minor polypharmacy and 373 prescriptions were majorpolypharmacy. The results showed that major polypharmacy was more prevalent among the cardiovascular diseases (31.5%) followed by the infectious diseases (23.67%) and was seen to be least in dermatological diseases (0.67 %); the minor polypharmacy was prevalent in gastrointestinal disorders (24.07 %) followed by the infectious diseases (20.10 %) and least in dermatological diseases (1.74 %).Based on the information obtained from our study suggestions to reduce the polypharmacy related problemsare as follows: Ask patients to bring all medicines to counseling center ; Control *pro re nata* prescribing; Select a drug that have more than one indication; Start with low doses and titrate dose according to effect; Monitor for adverse reactions and check for potential drug interactions; Routinely check and encourage compliance; Periodically simplify the therapeutic regimen and stop drugs if possible; Educate the patient about the drug therapy and teach the patient to prioritize the currently used drugs; Place limits on the duration of drug prescribing.

**Keywords**: Polypharmacy, Drug therapy, Drug utilization, Prescribing pattern.

## INTRODUCTION

Polypharmacy is the use of several drugs or medicines together in the treatment of disease, suggesting indiscriminate, unscientific, or excessive prescription. Polypharmacy is defined as a condition in which a patient receives too many drugs for too long time, or drug in exceedingly high doses often result.[1] The unavoidable consequence is that increasingly frail patients are being treated with Polypharmacy.[2] Chesteret al have mentioned that there is no consistent definition for polypharmacy in the literature and that many authors define it simply as the use of five or six medications.[3] However polypharmacy is much more complex than just the number of medication a patient uses.[4,5] Polypharmacy may be appropriate if all drugs in the regimen address recognized indications or inappropriate if more drugs prescribed than necessary, drugs with unacceptable side effects or toxicity prescribed, either when used alone or in combination with other medications in the regimen, or redundant drugs prescribed.

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Polypharmacy in a managed care setting presents a unique set of challenges and opportunities.[6] Intervention to reduce polypharmacy must address several issues such as appropriate medication usage in elderly, including the appropriateness 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, and education of member regarding adverse drug effects and other issues related to compliance.[7]

There are many potential risks associated with polypharmacy. When several medications are used simultaneously, there is an increased risk of drug-drug interactions and adverse drug reactions.[8] Epidemiological studies of risk factors for adverse drug reactions have shown that the number of concurrently used drugs is the most important predictor of these complications.[9]

Polypharmacy increases the risk of hospitalizations, and medication errors.[10,11] These factors eventually lead to increased patient costs, non-adherence to treatment, increased rate of patient morbidity and mortality.[12, 13]

Studies from many countries have shown that a

considerablepart of hospital admissions is precipitated by drug-related problems and iatrogenic illness.[14] Polypharmacy may be responsible for unnecessary health expenditures directly due to the cost of superfluous medication, but also indirectly due to the increased number of hospitalizations caused by drug-related complications.[15] The beneficial effect of reducing the occurrence of polypharmacy in the population has been addressed in order to cut down on expenditures for both physician and hospital services. A study examining the factors associated with variations in general practitioner prescribing costs showed that diagnoses associated with multiple drug use (cardiovascular diseases, diabetes mellitus, psychiatric disorders) were strongly related to high drug expenditures. The occurrence of multi-morbidity predicted high prescribing costs. A considerable part of the health care resources is thus used for costs due to expensive multiple drug regimens and expenditures caused by drug-related morbidity attributable to polypharmacy.[16]

The present study was aimed to identify the prevalence and the associated risk factors of polypharmacy in our hospital settings.The main purpose of this study was to develop a prescription database and to compare different methods of identifying drug users exposed to polypharmacy.

## MATERIALS AND METHODS

The study was conductedinGovernment District Head Quarters Hospital, Ooty for a period of one year (August 2009 to April 2010). The study involved collection of data both prospectively and retrospectively. All prescriptions which contain more than one drug and of age between 2-70 years were included in the study. Patients with age less than 2 years and with conditions like psychiatric & cancer disorders were excluded from the study.  Polypharmacy was classified according to British National Formulary (BNF)i.e. the concurrent use of 2 to 4 drugs are classified as minor polypharmacy and of five or more drugs as major polypharmacy.

The study protocol was approved by the Institutional Review Board of JSS College of Pharmacy, Ooty, India. The prescriptions were collected from patient's hospital records and patient counseling center after getting consent from the patients.The collected prescriptions were entered into Microsoft Office Excel sheet according to their age, gender, therapeutic category; number of prescription, length of hospital stay etc. and a prescription database was generated. All collected prescription details were scrutinized and were classified as major or minor polypharmacy.

## RESULTS

A total of 1003 prescriptions were collected from the Government District Head Quarters Hospital. Out of 1003

prescriptions 600 prescriptions found with major polypharmacy and 403 prescriptions with minor polypharmacy.

In our total study population 670 (66.80%) cases were males and 333 (33.20%) were females.The total populations were classified into three major age groups and patient in each group were recorded. The data from our study represent that; up to 18 years 4.39% (N=44), 19-60 years 83.75% (N=840) and above 60 years 11.86% (N=119). Graphical representation of age distribution in the study population is given in Figure1.



Fig. 1: Age Vs Total number of prescription
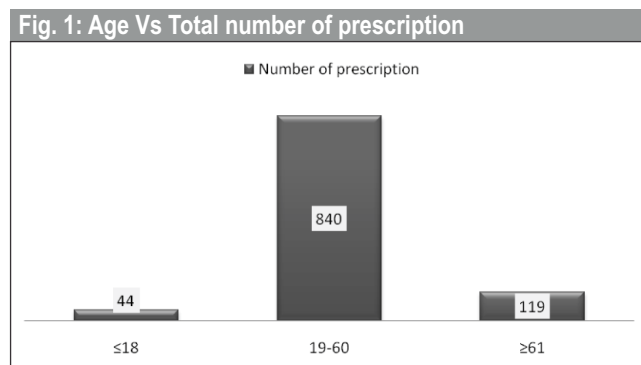
## Quantitative Estimation of Polypharmacy

Out of 1003 prescriptions 403 (40.18%) prescriptions were found to be of minor polypharmacy and 600 (59.82%) prescriptions were of major polypharmacy.

**a) Polypharmacy Vs Gender:**   In minor Polypharmacy (N=403), 227 were males and 176 were females. Out of 600 major Polypharmacy, 443 were males and 157 were females.Table 1 explains the prevalence of Polypharmacy in both genders in the study population.

| Table 1: Polypharmacy Vs Gender | | | | |
|---|---|---|---|---|
| Number of drugs | Male | Female | Total | Percentage |
| 2-4 | 227 | 176 | 403 | 40.18% |
| ≥5 | 443 | 157 | 600 | 59.82% |

**b) Polypharmacy Vs Age**: The numbers of drugs prescribed to the various age groups were analyzed and are presented in Table 2.

| Table 2: Polypharmacy Vs Age | | | |
|---|---|---|---|
| Number of drug prescribed | Age Group | Number of prescription | Percentage |
| 2-4 | ≤ 18 | 24 | 5.96% |
| | 19-60 | 316 | 78.41% |
| | ≥6 | 163 | 15.63% |
| ≥5 | ≤ 18 | 20 | 3.33% |
| | 19-60 | 524 | 87.33% |
| | ≥61 | 56 | 9.33% |

**c) Polypharmacy Vs Hospital stays:** The association of polypharmacy and hospital stay was analyzed and the results are given in Table 3. In both minor and major polypharmacy hospital stay less than one week found. In major polypharmacy about 45.50% had one to two weeks of hospital stay.

**Quantitative Estimation of Therapeutic Categories of Prescriptions**: The collected prescriptions were classified according to the British National Formulary and the number of prescriptions in each category is given in Table 4. Out of the total prescriptions cardiovascular, infections and gastrointestinal system accounted for major cases. The percentage of therapeutic categories of all prescribed drugs in the study population is graphically represented in Figure 2.

**d) Therapeutic class Vs Polypharmacy:** The assessment of polypharmacy in each therapeutic class was carried out and the prevalence of polypharmacy was estimated. The results are presented in Table 5. The results shows that major polypharmacy is more prevalent in cardiovascular system diseases (31.5%) followed by infectious diseases (23.67%).

**e) Therapeutic class Vs Age group:** The patient prescribed with cardiovascular drugs and gastrointestinal drugs were more often involved in the polypharmacy among the elderly population, while infectious and cardiovascular drugs were prominent among young individuals exposed to polypharmacy. The table 6 represents the conception of therapeutic class of drug by different age group.

**f) Therapeutic class Vs Hospital stays:** The duration of treatment varies with severity of disease. Our result shows the heterogeneous data with respect to duration of therapy and
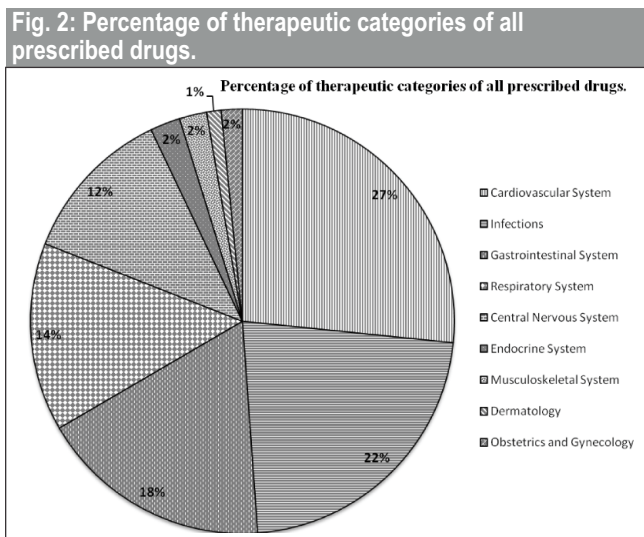


**Fig. 2: Percentage of therapeutic categories of all prescribed drugs.**

### Table 4: Quantitative Estimation of Therapeutic Categories of Prescriptions

| Therapeutic class | Number of prescription collected | Percentage |
|---|---|---|
| Cardiovascular System | 267 | 26.62% |
| Infections | 223 | 22.23% |
| Gastrointestinal System | 178 | 17.75% |
| Respiratory System | 144 | 14.36% |
| Central Nervous System | 120 | 11.96% |
| Endocrine System | 23 | 2.29% |
| Musculoskeletal System | 21 | 2.09% |
| Dermatology | 11 | 1.10% |
| Obstetrics and Gynecology | 16 | 1.60% |

### Table 3: Polypharmacy Vs Hospital stay

| Number of drugs | 1 week | 1-2 week | >2 week | Total | Percentage of total prescription |
|---|---|---|---|---|---|
| 2-4 | 258 (64.02%) | 117(29.03%) | 28(6.95%) | 403 | 40.18% |
| ≥5 | 296 (49.33%) | 273(45.50%) | 31(5.17%) | 600 | 59.82% |

### Table 5: Therapeutic class Vs Polypharmacy

| Therapeutic class | Minor Polypharmacy (2-4 drugs) | Percentage (%) | Major Polypharmacy (≥5) | Percentage (%) |
|---|---|---|---|---|
| Cardiovascular System | 78 | 19.35 | 189 | 31.50 |
| Infections | 81 | 20.10 | 142 | 23.67 |
| Gastrointestinal System | 97 | 24.07 | 81 | 13.50 |
| Respiratory System | 73 | 18.11 | 71 | 11.83 |
| Central Nervous System | 44 | 10.92 | 76 | 12.67 |
| Endocrine System | 11 | 2.73 | 12 | 2.00 |
| Musculoskeletal System | 12 | 2.98 | 9 | 1.50 |
| Dermatology | 7 | 1.74 | 4 | 0.67 |
| Obstetrics and Gynecology | Nil | Nil | 16 | 2.67 |

therapeutic category of drugs. Prevalence of short term therapy was high with gastrointestinal and infectious diseases whereas long term therapy was prominent with cardiovascular and respiratory diseases. TheTable 7.1 and 7.2 represents the length of hospital stays for different therapeutic category.

## DISCUSSION

Polypharmacy was a frequent condition in Indian population especially among elderly population. Polypharmacy mainly depends on the type of the disease and co-morbid conditions.The majority of drug users exposed to polypharmacy exhibited a very heterogeneous pattern of drug combination and mostly individual subject to major polypharmacy had their own unique drug combination, differ from all other drug users.

**Table 6: Therapeutic class Vs Age group**

| Variable | Age | | |
|---|---|---|---|
| Therapeutic class | ⩽18 | 19-60 | ⩾61 |
| | (n=44) | (n=840) | (n=119) |
| Cardiovascular System | Nil | 235(27.98%) | 32(26.89%) |
| Infections | 16(36.36%) | 195(23.21%) | 12(10.08%) |
| Gastrointestinal System | 11(25.00%) | 143(17.02%) | 24(20.17%) |
| Respiratory System | 2(4.55%) | 126(15.00%) | 16(13.45%) |
| Central Nervous System | 8(18.18%) | 89(10.60%) | 23(19.33%) |
| Endocrine System | Nil | 17(2.02%) | 6(5.04%) |
| Musculoskeletal System | 2(4.55%) | 16(1.90%) | 3(2.52%) |
| Dermatology | 5(11.36%) | 3(0.36%) | 3(2.52%) |
| Obstetrics and Gynecology | Nil | 16(1.90%) | Nil |

**Table 7.1: Therapeutic class Vs Hospital stays (Minor Polypharmacy)**

| Variable | Length of hospital stay for Minor Polypharmacy | | |
|---|---|---|---|
| Therapeutic category | ⩽1 week | 1-2 week | ⩾2 week |
| | (n=258) | (n=117) | (n=28) |
| Cardiovascular System | 52(20.63%) | 23(19.66%) | 3(10.71%) |
| Infections | 58(23.02%) | 17(14.53%) | 6(21.43%) |
| Gastrointestinal System | 70(27.78%) | 17(14.53%) | 10(35.71%) |
| Respiratory System | 32(12.70%) | 38(32.48%) | 3(10.71%) |
| Central Nervous System | 18(7.14%) | 22(18.80%) | 4(14.29%) |
| Endocrine System | 9(3.57%) | Nil | 2(7.14%) |
| Musculoskeletal System | 12(4.76%) | Nil | Nil |
| Dermatology | 7(2.78%) | Nil | Nil |
| Obstetrics and Gynecology | Nil | Nil | Nil |

**Table 7.1: Therapeutic class Vs Hospital stays (Major Polypharmacy)**

| Variable | Length of hospital stay for Major Polypharmacy | | |
|---|---|---|---|
| Therapeutic category | ⩽1 week | 1-2 week | ⩾2 week |
| | (n=296) | (n=273) | (n=31) |
| Cardiovascular System | 89(30.07%) | 96(35.16%) | 4(12.90%) |
| Infections | 76(25.68%) | 60(21.98%) | 6(19.35%) |
| Gastrointestinal System | 39(13.18%) | 40(14.65%) | 2(6.45%) |
| Respiratory System | 26(8.78%) | 39(14.29%) | 6(19.35%) |
| Central Nervous System | 36(12.16%) | 29(10.62%) | 11(35.48%) |
| Endocrine System | 9(3.04%) | 1(0.37%) | 2(6.45%) |
| Musculoskeletal System | 9(3.04%) | Nil | Nil |
| Dermatology | 4(1.35%) | Nil | Nil |
| Obstetrics and Gynecology | 8(2.70%) | 8(2.93%) | Nil |

In this study we used hospital case sheets of patients for the estimation of incidence and prevalence of polypharmacy.In our study prescriptions were classified into minor polypharmacy (2 to 4 Drugs) and major Polypharmacy (>5 Drugs). Polypharmacy is more prevalent in the age group 19 to 60 years. Reason may be increase in the prevalence of disease and change in physiology or increase in the number of elderly population.In the most of the studies of polypharmacy female sex and old age have been predictors of polypharmacy, but few studies have not found this correlation. Our results show that there is a higher prevalence of polypharmacy among the men than women.In our study we found that the length of hospital stay has shown an increase in major polypharmacy compare to minor polypharmacy.Because of age related changes in pharmacokinetics (i.e., absorption, distribution, metabolism, and excretion) and pharmacodynamics (the pharmacologic effects of a drug), many drugs must be used with particular caution elderly patients. Our data suggests that prevalence of cardiovascular drugs and gastrointestinal drugs were more often involved in the polypharmacy among the elderly population, while infectious and cardiovascular drugs were prominent among young individuals exposed to polypharmacy.

Based on the knowledge obtained from our study, suggestions to reduce the problems associated with polypharmacy are as follows:

- Ask patients to bring all medicines to the counseling center (the brown bag approach)

- Restrict *pro re nata* prescribing

- Encourage physicians to prescribe using evidence-based medicine

- Select a drug that may treat more than one condition

- Check for contraindications and potential drug interactions before prescribing a drug

- Start with low doses and titrate dose according to effect

- Monitor for adverse reactions and check potential drug interactions

- Educate the patient about the drug therapy and teach the patient to prioritize the currently used drugs

- Routinely check and encourage compliance

- Periodically simplify the therapeutic regimen and stop drugs if possible

- Place limits on the duration of drug prescribing

## CONCLUSION

The use of medication to disease condition is necessary, but unnecessary load of drugs to patient will increase the safety problems. Polypharmacy can be avoided by sharing the decisions for making treatment goals and plans. The medication regimen can be simplified by eliminating pharmacological duplication, decreasing dosing frequency and regular review of drug regimen. The goal should be to prescribe the least complex drug regimen for the patient as possible while considering the medication problems, symptoms and off course the cost of therapy.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## ACKNOWLEDGMENTS

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