IOSR Journal Of Pharmacy www.iosrphr.org
(e)-ISSN: 2250-3013, (p)-ISSN: 2319-4219
Volume 7, Issue 12 Version. 1 (December 2017), PP. 65-74

A Pharmacoeconomic Study of Consequences, Continuity & Adherence of Polypharmacy in Elderly Patients

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Abstract
Aim: *A study of consequences, continuity & adherence of polypharmacy in elderly patients*
Objectives: *To find out the prevalence of polypharmacy and unnecessary medication use, to investigate the extent and reasons for modification to the medication regimen in elderly patients and to study their adherence to treatment after modification.*
Methodology: *A prospective observational study was conducted in multiple tertiary care centers of various departments. The data was categorized based on various parameters like age, gender, co morbidities, antibiotic usage in geriatrics and drugs per prescription were collected and analyzed.*
Results: *Among 200 cases we have found that 166 cases contain more than 5 drugs respectively. From the results, most frequently occurring errors, their severity and nature of errors was also assessed. Out of 200 cases 113 medication errors were found in which drug- drug interactions were noticed in 107 cases, adverse drug reaction noticed in one case and 5 prescribing errors were found.*
Conclusion: *The average cost per prescription as calculated for 1-3 drugs is 65.74rs, for 3-5 drugs is 454.5 rupees and prescription containing more than 5 drugs is 1020.38 rupees. The average cost of antibiotics in 1-3 drug prescription was found to be 108.82 rupees. The average cost of prescriptions having 3-5 drugs and above 5 drugs was found to be 135.57 rupees and 534.705 rupees respectively.*

Date of Submission: 12-12-2017 Date of acceptance: 30-12-2017

I. INTRODUCTION

Polypharmacy

The word "poly" is derived from the Greek word meaning more than one and that "pharmacy" referring to the Greek word for drug "pharmacon" [1]. Polypharmacy is defined by the world health organisation as "The administration of many drugs at the same time or the administration of an excessive number of drugs".

Unfortunately, there is no standard cut point with regard to the number of medications that is agreed upon for the definition of polypharmacy [1]. Although, majority of studies have applied five or more prescribed drugs as the threshold of polypharmacy. Older people are rapidly increasing in number throughout the world in both developed and developing countries, and among this group multiple chronic and degenerative disorders are highly prevalent [6]. Polypharmacy has been a persistent issue in caring for older persons. The use of excess numbers of medications is burdensome in many ways to older patients.

Higher age is associated with multimorbidity, which is widespread medical problem often leading to polypharmacy and potentially inappropriate medication (PIM) [3]. Ageing is associated with various physiological alterations such as changes in body composition and reduction in kidney and liver functions, can significantly change pharmacokinetic and pharmacodynamic properties. Alteration of age related pharmacokinetics and pharmacodynamics predisposes older adults to drug related problems such as adverse drug reactions (ADRs), drug-drug interactions, drug-disease interactions [2]. Self-medication is a potential cause of polypharmacy and the availability of diverse over-the-counter drugs, especially potentially inappropriate medications for older people, exacerbate this problem [8]. Other issues related to drug use include low literacy in general or low health literacy in particular. Additional contributing factors include miscommunication or misunderstanding physician orders as a result of cognitive dysfunction, and mistaking drugs because of similarity in shape or colour, both of which can arise more often in older age groups [8].

The King's Fund proposed a classification where treatment with multiple medicines may be either "appropriate or problematic" [5].

Identification of potentially inappropriate medications

To prevent PIM use, experts have begun to address this issue and devise screening tools to assess the extent of PIMs and guide clinical practice in older adults. One of the first consensuses of experts was achieved by Beers et al in the USA in 1991, which was proposed by an expert panel using the Delphi method. The American Geriatrics Society Beers Criteria for PIM Use in Older Adults is an explicit list of PIMs that should be avoided in older adults in general and in people with certain diseases or syndromes, prescribed at a reduced dosage or used with caution or careful monitoring. The Beers criteria are one of the most frequently consulted sources and were updated in 2003 and 2012 [10]. The Screening Tool to alert doctors to the Right Treatment (START) or the Screening Tool of Older Persons' potentially inappropriate Prescription (STOPP), which focus on avoiding inappropriate drugs (STOPP) or to identify under treatment medications (START).
STOPP criteria identified a significantly higher proportion of patients requiring hospitalization as a result of PIM-related adverse events than Beers' criteria [9].

Continuity of care in polypharmacy

Continuity of care is considered foundational to high-quality care [3]. Better continuity of care (COC) is associated with improved health care outcomes, such as decreased hospitalization and emergency department visit. Traditional continuity of care constructs may adequately characterize care quality in general populations, but may merit reconceptualization for patients with multiple chronic conditions [3]. Specifically, interactions between multiple chronic condition patients and providers involve complex medication management; therefore care continuity measurement may be more relevant if focused on the provider subset who prescribes essential medications for chronic conditions [3]. If continuity of medication management is validated in diverse populations, correlated with patient outcomes, and responsive to change, then it may be an important target for improving the health and health care of multiple chronic condition patients [3]. Better continuity of care is associated with fewer negative health care outcomes and lower expenses, partially through the reduction of potentially inappropriate medication. Improving COC deserves more attention in future health care reforms [4].

Adherence to polypharmacy

The World Health Organization (WHO) defines medication adherence as the extent to which a person´s behavior - taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider [6].
Non-adherence describes the patient who does not or only partially follow the treatment arrangements previously agreed with the doctor. Medication adherence (the patients' use of the right drug in the correct dose at the right interval), which is a key factor associated with the effectiveness of all pharmacological therapies is essential in the treatment of the elderly [6]. Medication taking behavior is complex and involves patient, physician, and process components. Increasing adherence may have a bigger effect on health than improvement in specific medical therapy [6]. Identification of non-adherence is challenging and requires specific skills. If not recognized, the non-adherence can lead to a dose augmentation of the initial medication or the addition of a second drug, thereby increasing the risk for ADRs, increased emergency visits, hospitalizations, lower quality of life and increased health care costs.

Adherence to a medication regimen depends on prospective and retrospective memory. Prospective memory helps the patient remember to take the medication whereas retrospective memory is needed to help the patient remember a dose has already been taken [7]. When prescribed an antibiotic or other short-term prescription drug, most of us have experienced one or both kinds of memory failure: prospective (Oops, I forgot to take my pill this morning!) as well as retrospective (Did I take that pill or not?) The failure of our memory on such occasions, even when we have only one medication to take for days to a few weeks, gives us a good appreciation for what it must be like trying to manage five or more chronically administered medications [7].
Efforts are needed not to just reduce medications, but to reduce the use of inappropriate medications and increase the use of appropriate medications [6]. Positive outcomes include health-related quality of life, reductions in acute exacerbations of chronic diseases, and the cost-effectiveness of interventions [7]. Assessment of patients' perspectives of these interventions should not be ignored. Lack of understanding of patient preferences can interfere with good doctor-patient communication, which is important for optimal medication adherence. Like chronic disorders, polypharmacy and medication adherence are complex phenomenon that must be monitored in an ongoing and longitudinal fashion [7].

II. METHODS

A prospective observational study was conducted in multiple tertiary care centers of various departments. The data was categorized based on various parameters like age, gender, co morbidities, antibiotic usage in geriatrics and drugs per prescription were collected and analyzed.

III. RESULTS

The study was carried out in geriatric patients out of which males were(53.5%) and females were (43.5). Out of which the patients of age group from 55-65 were (56.5%), age group from 65-75 were (28.5%) and age group above 75 were (15%). Out of the total cases medication errors were observed in (56.5%) cases. Out of which most of them were prescribing errors (2.5%) and adverse drug reaction (0.5%) and drug-drug interactions (53.5%). The average cost per prescription as calculated for 1-3 drugs is 65.74rs, for 3-5 drugs is 454.5 rupees and prescription containing more than 5 drugs is 1020.38 rupees. The average cost of antibiotics in 1-3 drug prescription was found to be 108.82 rupees. The average cost of prescriptions having 3-5 drugs and above 5 drugs was found to be 135.57 rupees and 534.705 rupees respectively. The sequential therapy was calculated which is categorized into three,

S1- Drug with same generic name different class
S2 -Drug with same class, different action
S3 -Drug with same action, different class

Among all the cases S1 (sequential therapy) found to be 20.19%, S2 (switch therapy) found to be 40% and S3 (step-down therapy) found to 37.5%, this conclude that S2 (switch therapy) drugs were more in number. The reason for patient adherence to step down type of conversion were newer drug prescribed for improvement of therapy and patient showing compliance to oral medications were 26 and 15 respectively.
Most of the errors are clinically significant and it can be prevented by working together in a healthcare team. We experienced that most of the medication errors was mainly due to poor prescription writing.

IV. DISCUSSION

A total of 200 medical case records were evaluated among which 107 (53.5%) were males and 93 (46.5%) were females. It was observed that the highest number of cases were in the age group 55-65 (56.5%), followed by 65-75 age group (28.5%) and >76 age group (15%). Further categorization was done based on co morbidities found in patients. The most prevalent of them being a combination of hypertension and diabetes followed by hypertension alone and then diabetes mellitus. The least prevalent co-morbidity was found to be chronic kidney disease. No. of drugs per prescription in each case was analyzed and categorized as following: 1-3 drugs/prescriptions are 5 cases, 3-5 drugs per prescription are 29 cases, drugs with more than 5 per prescription are found to be 166 cases. By which poly pharmacy was found in 67.91% of cases ,which increase the risk of medication errors in prescription.

Medication reconciliation:

After demographical evaluation, medication reconciliation process was assessed whether done or not done. If done whether only illness history was taken, or both history and drugs were taken or there was no particular illness in the patient. Results showed in 60 cases medication reconciliation was not taken and in 140 cases it was taken out of which only illness history was taken for 46 cases, both illness history and drugs were taken for 34 cases and in 60 cases there was no significant past illness in the patient. Medication errors were classified into following categories: prescribing errors, administration errors, transcription errors, monitoring errors, dispensing errors. Here we are mainly concentrating on prescribing errors and administration errors. Out of 200 cases 107 drug-drug interactions were found, 5 prescribing errors and an adverse drug reaction was found.

The average cost per prescription as calculated for 1-3 drugs is 65.74, for 3-5 drugs is 454.5 and prescription containing more than 5 drugs is 1020.38. The average cost of antibiotics in 1-3 drug prescription was found to be 118.82. The average cost of prescriptions having 3-5 drugs and above 5 drugs was found to be 135.57 and 534.705 rupees respectively. Among all the cases, the numbers of cases with Sequential therapy (S1) were found to be 21, Switch therapy (S2) were found to be 42 and numbers of cases with Step down therapy (S3) were found to be 41. Reasons for patient's adherence to step down type of conversion were newer drug prescribed for improvement of therapy and patient showing compliance to oral medications were 26 and 15 respectively.

V. LIMITATIONS OF THE STUDY

Random selection of patients was done in our study. So, the results cannot be generalized to all the patients admitted in the Hospital, as many cases might have been missed during night shifts.

VI. CONCLUSION

The study concentrated at determining the medication errors and cost evaluation in elderly patients. In our study the patients of age group between 55 to 85 were included; among them we found that males were more in number. Among 200 cases we have found that 166 cases contain more than 5 drugs respectively. From

the results, most frequently occurring errors, their severity and nature of errors was also assessed. Out of 200 cases 113 medication errors were found in which drug- drug interactions were noticed in 107 cases, adverse drug reaction noticed in one case and 5 prescribing errors were found. This information will be helpful in preventing medication errors in the therapy and steps can be taken to counter them.

The classes of drugs which were inappropriately prescribed were identified. Individual drugs prescribed inappropriately were also identified, of which antibiotics were found to be most inappropriately prescribed. Cost burden incurred due to the medication errors was calculated and categorized. The classes of drugs that costs the most are antibiotics which summed up to three fourth of the total cost of errors. Of this ceftriaxone was found to be with highest cost burden in terms of monetary value. The average cost per prescription as calculated for 1-3 drugs is 65.74rs, for 3-5 drugs is 454.5 rupees and prescription containing more than 5 drugs is 1020.38 rupees. The average cost of antibiotics in 1-3 drug prescription was found to be 108.82 rupees. The average cost of prescriptions having 3-5 drugs and above 5 drugs was found to be 135.57 rupees and 534.705 rupees respectively

Thus prescription analysis can have a positive impact on the quality of patient care by identifying the medication errors and reducing its cost burden on therapy Given the economic and medical burden associated with medication errors, strategies for preventing them are needed for improving patient safety and reducing economic burden. Therefore strict guidelines having global standards should be formulated, upon implementation of it would be helpful towards prescribing a rational drug therapy. Clinical pharmacist, bridge between patients and doctors can help in selection of economic and rational drug therapy which would be helpful in improving patient safety and reducing economic burden of the therapy in patients.

ACKNOWLEDGEMENTS

We are immensely thankful to Vijay Marie hospital and Omni hospital, JNTUniversity, Management and Principal of Pulla Reddy Institute of Pharmacy, for their constant encouragement and support provided during the study.

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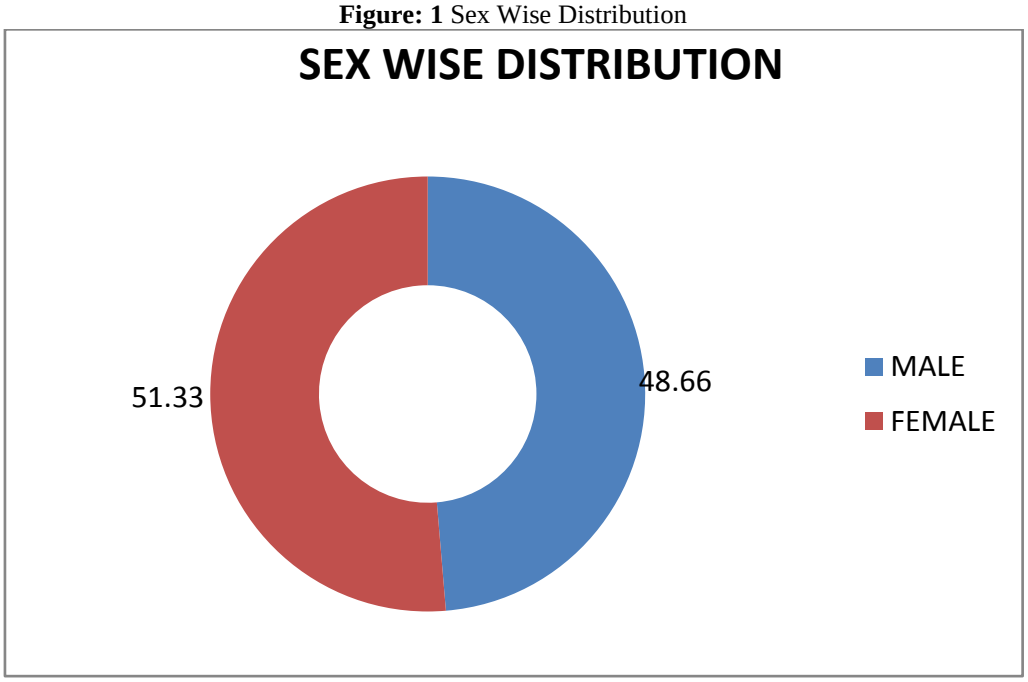
RESULTS

A total of 200 case records were reviewed, analyzed and categorized based on gender, age group, medication reconciliation, length of hospital stay, and number of drugs prescribed.

Demographic Profile Of Study Population:

Figure: 1 Sex Wise Distribution



Distribution based on medication reconciliation:

Table: 1 age wise distribution

AGE GROUP(in years)	NO.OF CASES	PERCENTAGE
55-65	113	56.5 %
66-75	57	28.5 %
>76	30	15 %

Figure: 2 Distributions Based On Length Of Stay

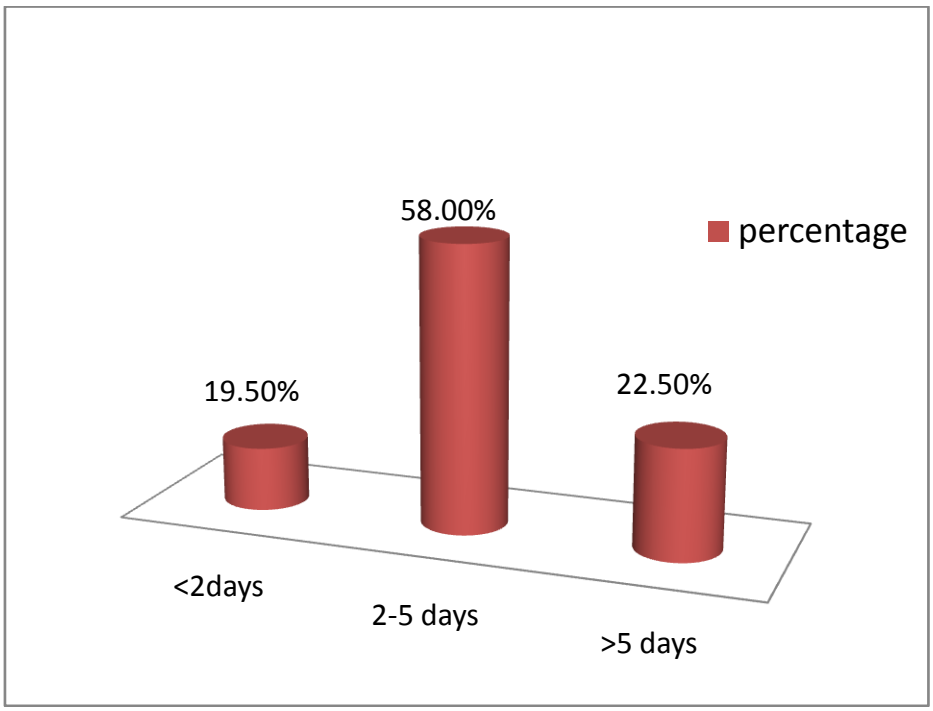


Table: 2 Number Of Drugs Given Per Patient

NO.OF DRUGS	NO.OF CASES	PERCENTAGE
1-3	5	2.5 %
3-5	29	14.5 %
>5	166	83 %

Figure: 3 Number Of Drugs Given Per Patient

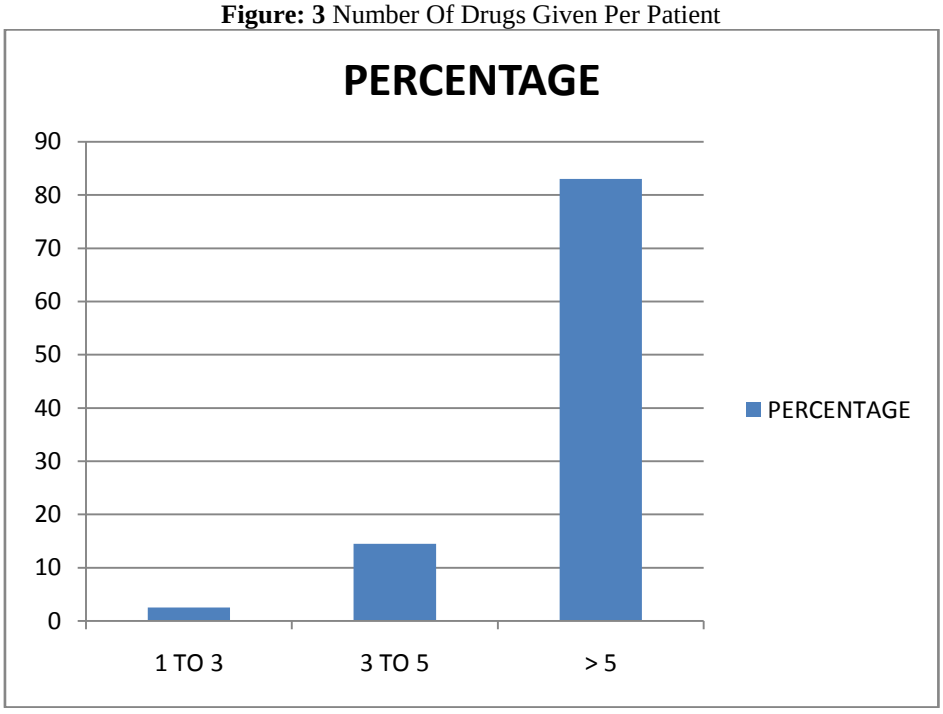


Figure: 4 Distributions Based On Co Morbidities

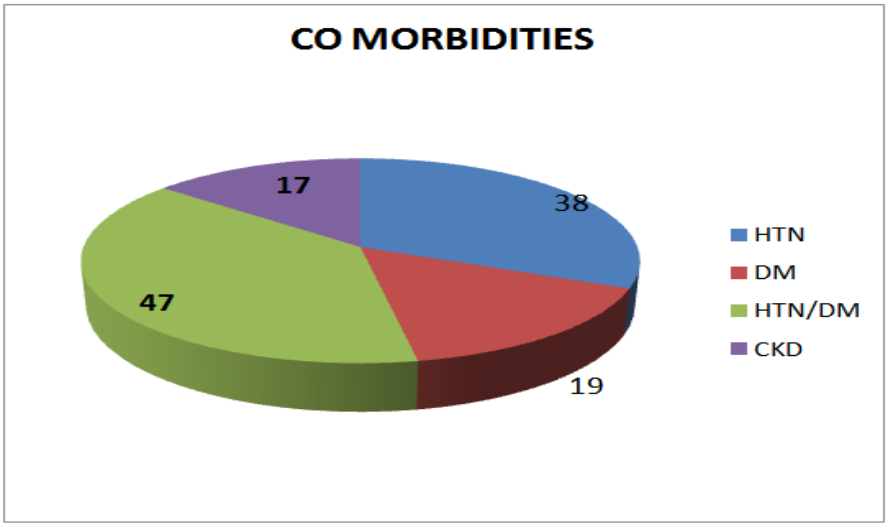


Figure: 5 no. Of antibiotics / prescription

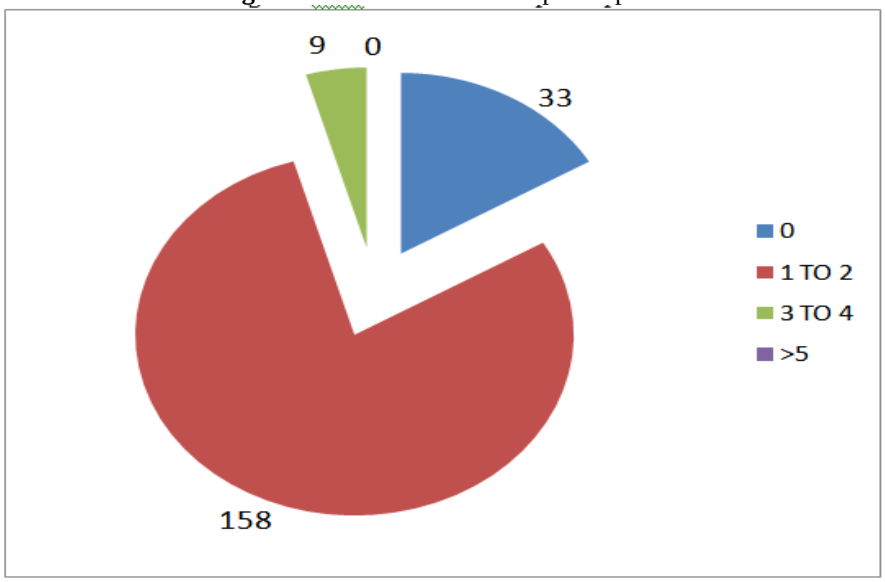


Figure: 6 Different Types Of Medication Errors

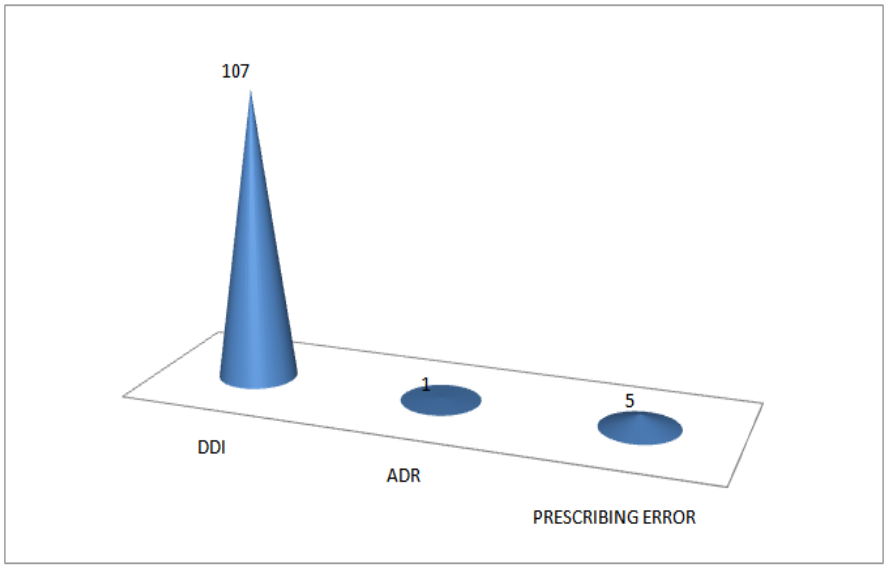


Figure: 7 Burden On Patient

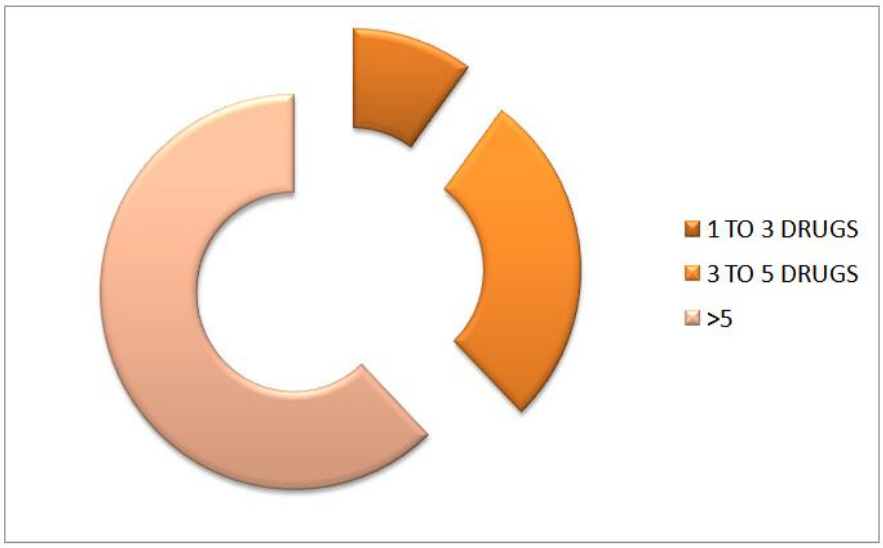


Figure: 9 Type Of Conversion

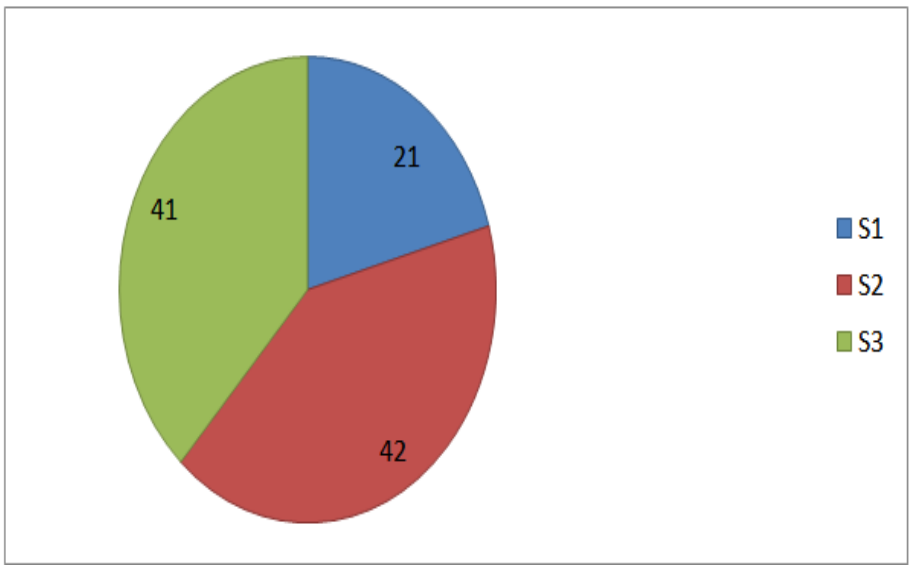


Figure: 10 Administrations Of Antibiotics

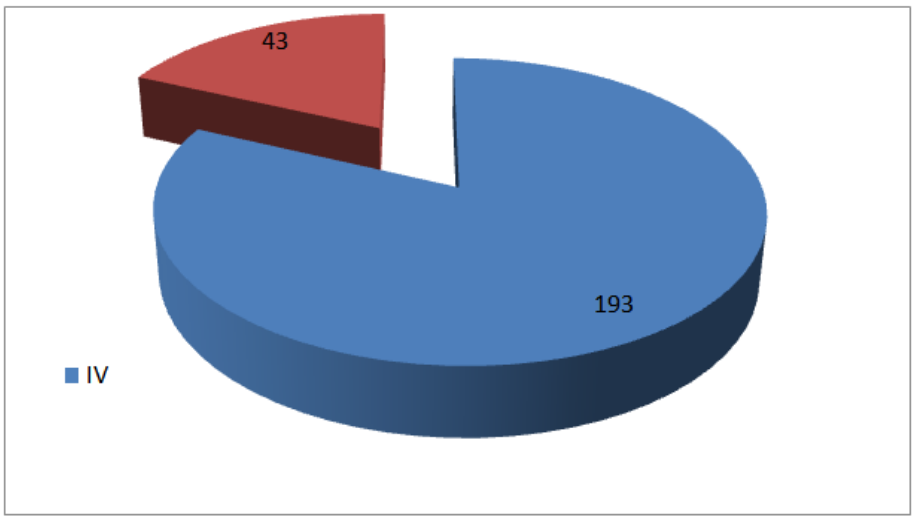


Figure: 11 Cost Of Antibiotics

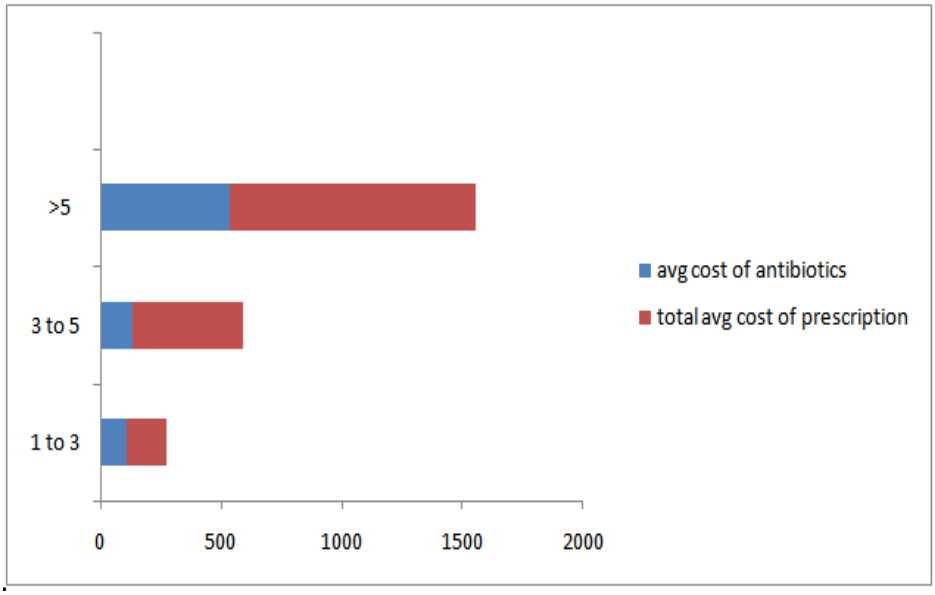
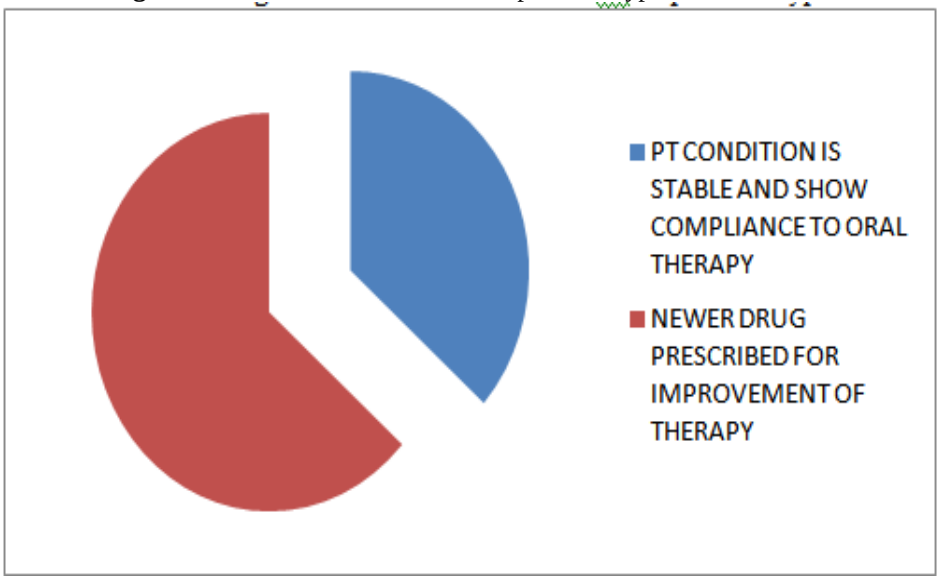


Figure: 12 Patient Adherences To Step Down Type Of Conversion



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Dr.Anusha Joel.A. "A Pharmacoeconomic Study of Consequences, Continuity & Adherence of Polypharmacy in Elderly Patients." IOSR Journal of Pharmacy (IOSR-PHR), vol. 07, no. 12, 2017, pp. 65-74.