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# **A CROSS-SECTIONAL STUDY ON THE PREVALENCE AND IMPACT OF POLYPHARMACY IN GERIATRIC POPULATION**

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# ABSTRACT

## BACKGROUND

Multiple diseases and multimorbidity inevitably lead to the use of multiple drugs, a condition known as polypharmacy. Over the last 20–30 years, problems related to aging, multimorbidity, and polypharmacy have become a prominent issue in global healthcare. The use of polypharmacy will give some impact on the elderly, including increasing the improper treatment, adverse drug reactions (ADRs), and some of the problems that affect the changing nature of the pharmacokinetics and pharmacodynamics of drugs.

## METHODS

The study was conducted in geriatric patients admitted in NIMS medcity. The data for the study was collected prospectively and recorded in a data collection form specially designed for the study based on inclusion and exclusion criteria obtained from the Department of General Medicine, NIMS Hospital, Neyyattinkara, Thiruvananthapuram of geriatrics patients admitted during the period of 6 months from December 2021 to May 2022.

## RESULTS

In our study out of 138 patients studied, 51.45% (N=71) were males and 48.55% (N=67) were females and the most prominent age group was found in between 65-74yrs (68.84%, N=95). The most common disease was stroke (10.87%). According to kuppuswamy scale of socio-economic status, most of them belonged to upper lower class (42.75%, N=59). By using WHO indicators total number of drugs prescribed (1135, 12.15%), total number of drugs prescribed by generic name (170, 14.97%), total number of drugs prescribed by brand name (965, 85.02%), total number of drugs encountered with antibiotics (276, 24.31%), total number of drugs encountered with injections (356, 31.36%), total number of drugs prescribed from essential drug list (1135, 100%). We also demonstrated highest number of types of polypharmacy comes under adjunctive polypharmacy (76.09%) followed by multiclass polypharmacy (68.84%), augmented polypharmacy (64.49%), same class polypharmacy (44.20%). we also demonstrated a relationship between socio economic status and cost from the mean values for all class of socio-economic scale such as upper, upper lower, lower middle, are closer to each as thus it can cause an impact or burden to the lower classes.

# INTRODUCTION

## 1.1 GERIATRIC POPULATION

The population aged 60 years and above is termed as geriatric population. The countries like India have very wide population and people aged 60 years or above is more<sup>[1]</sup>. While taking the proportion of total population the geriatric population is increased in a considerable manner, this wide growth of elderly population is a major challenge in medical profession and also for society<sup>[2]</sup>. Geriatrics or the geriatric medicines that mainly focus on the care of elderly people. The word Geriatrics comes from the Greek word *geron* which means that old man and *iatros* meaning healer. Geriatrics also known as medical gerontology. The main objective or aim is to improve the quality of life, treating the diseases in older people. The geriatric population have variety of communicable and non-communicable diseases and also have disorders in vision, hearing, degenerative conditions. Persons belongs to lower class have poor adherence to treatment because of high cost medicines and health care facilities<sup>[3]</sup>.

**Table 1.1 Geriatric criteria based on WHO**

SL.NO	Age distribution	Age
1	Middle Age	45-59 years
2	Elderly	60-74 years
3	Old	75-90 years
4	Very old	> 90 years

Elderly patients are the major consumer of drugs because of chronic diseases, drug related problems occur due to physiological changes in the body, reduced organ function due to aging and multiple diseases<sup>[4]</sup>. Geriatric populations are more vulnerable to hearing and vision impairment that will lead to the social isolation, dependence, depression etc and the vision impairment leads to risk of falls and taking medications incorrectly. Hospitalization is more seen in patients especially age of above 65. Geriatric population have higher risk of occurring sensory changes, immunosenescence, multiple chronic conditions like hypertension, DM, cancer, arthritis and reduced physical functions etc, for managing these diseases they depend the medicines, number of drugs were increased according to the disease condition, but patients

who taking five or more medications is termed as polypharmacy that will lead to other DRPs and require further hospitalization.

## 1.2 POLYPHARMACY

The use or administration of five or more than five medications by a single patient is termed as the polypharmacy. The use of multiple medicines is more commonly seen in elderly people as one or more drug given to manage a condition and this polypharmacy leads to increased chances of adverse events, increased length of hospital stays, readmission to hospital after discharge etc<sup>[6]</sup>. Drugs are useful in the management of disease conditions and give life extension but the overuse of medication will lead to problems and it may be fatal in some time<sup>[7]</sup>.

### CAUSES OF POLYPHARMACY

- Self-medication without proper knowledge about disease, drugs and its reactions
- Lack of knowledge in physicians about polypharmacy and effects in elder patients
- Lack of communication between patients and health care providers
- Increased number of chronic disease conditions.

#### 1.2.1 TYPES OF POLYPHARMACY

##### Same class polypharmacy

Use of more than one medication from the same class. Eg: Use of two medications from proton pump inhibitors.

##### Multi class polypharmacy

Use of more than one medication from different classes for the same symptom.

Eg: Beta-blocker and calcium channel blocker for managing hypertension

##### Adjunctive polypharmacy

Use of one medication to treat the side effects of another medication from a different class.

Eg: Antibiotics and probiotics

##### Augmentation polypharmacy

Use of one medication at lower dose along with another medication from different

class in therapeutically full dose for the same disease.

Eg: Addition of lowest dose of haloperidol with patient taking risperidone <sup>[5]</sup>.

### 1.2.2 RISK OF POLYPHARMACY

Polypharmacy can be caused by a number of different circumstances. Multiple medical diseases handled by multiple subspecialist physicians, chronic mental health disorders, and living in a long-term care facility are all patient-related factors. Poorly updated medical records, automated refill systems, and prescribing to fulfil disease-specific quality metrics are all system-level problems. Patients with one or more chronic illnesses have longer drug lists, which makes polypharmacy more noticeable. Patients with mental illnesses are a group that is frequently disregarded when it comes to polypharmacy. These patients are frequently prescribed psychiatric drugs with negative side effects, and additional medications may be prescribed to reduce side effect profiles<sup>[8]</sup>. Despite the fact that people with chronic mental health and medical disorders may require many drugs to achieve optimal functioning and avoid illness sequelae, effective polypharmacy can nevertheless raise the risk of adverse drug events<sup>[8,9]</sup>. Adults in long-term care institutions are especially at danger, as they are more fragile than community-dwelling populations and have many medical conditions and cognitive impairment, which frequently necessitate pharmacologic therapy. Up to 91 percent of long-term care patients use at least five drugs every day.

In clinical terms, Polypharmacy:

- Increases adverse drug events and drug-drug interactions, as well as reduces medication adherence, are all factors.
- Is linked to poor patient outcomes, including hospitalisation.
- There is a statistical link between mortality.
- Adverse medication reactions cause more illness and death than most chronic diseases, with death rates exceeding those of several prevalent malignancies.
- For each extra medicine prescribed, there is an incremental rise in the chance of thirty-day hospital readmission.

The increased risk of adverse medication events is the most significant danger linked with polypharmacy (ADEs). Outpatients who took five or more drugs had an 88 percent higher risk of developing an ADE than those who took fewer prescriptions, according to a population-based study. Polypharmacy has also been linked to more difficult medication adherence<sup>[9]</sup>. This isn't surprising, given that when the number of drugs increases, patients have greater management issues, which increases the likelihood of medication nonadherence. "Polypharmacy without a rationale" has the potential to be problematic.

Polypharmacy can make it difficult for patients to stick to a pharmaceutical schedule in six ways:

1. Dosing schedule that is complicated
2. Misunderstandings about medication instructions
3. Negative effects
4. Reactions
5. Expensive
6. Frequency of filling and refilling

**Table1.2 Risk factors of polypharmacy**

Patient	Health care system
Cognitive impairment	Poor medical record keeping
Mental health conditions	Poor transitions of care
Multiple chronic conditions	Use of automated refill systems
Seeing multiple specialists	Prescribing to meet disease specific quality metrics

Polypharmacy is linked to a number of other health hazards like:

- Prescribing cascades are defined as "the situation in which a patient's initial drug creates adverse event signs and symptoms that are misconstrued as a new disease, resulting in the prescription of anew medication."
- A medicine's effectiveness is reduced as a result of the metabolic action of another medication.
- Deterioration and impairment of cognition
- Side effects that are excessive
- Changes in liver and kidney function make it difficult to adequately digest and eliminate severalmedicines.
- Hip fractures



- Falls
- Dry mouth
- Malnutrition

#### 1.1.4 RISK OF POLYPHARMACY IN GERIATRIC PATIENTS

The elderly is the most likely to have polypharmacy. Pharmaceutical errors, inappropriate medication usage, polypharmacy, non-adherence to therapy, and self-medication are all believed to raise the risk of drug-related disorders in the elderly.

### PHARMACOKINETIC PROCESSES IN GERIATRIC POPULATION

Because of the many age-related changes that occur in this age group, pharmacokinetics of medication therapy is an essential topic in the care of the elderly. Due to age-related physiologic changes that may entail a decline in functional reserve capacity, elderly patients take more medicines than their younger counterparts and are known to be at risk of side effects from many of the drugs they take <sup>[10]</sup>. These physiological changes with age have significant implications for the clinical management of elderly patients: drug metabolism is altered, changes in response to commonly used drugs necessitate different drug dosages, and rational preventive diet and exercise programmes are required to delay or reverse some of these changes. The physiologic effects of medications within the body are known as pharmacokinetics. Absorption, distribution, metabolism, and elimination are the four primary processes. Age-related changes can have a big impact on these processes and change the therapy's intended consequences.

- **Absorption:** Drug absorption for oral drugs can be affected by age-related changes in the gastrointestinal system. A reduction in the surface area of the intestinal epithelium can reduce the area of drug absorption and lengthen the time drugs stay in the intestine. Depending on the medication, a decrease in stomach motility might reduce or improve drug absorption. Medication disintegration and solubility can be affected, and drug absorption can be reduced, if digestive enzymes and gastric acid output are reduced. Drug absorption through the gut wall can be hampered by a reduction in gastrointestinal blood flow. Age-related skin changes may potentially affect transdermal medicines. Epidermal cell growth slows as people become older, resulting in skin thinning. With less subdermal fat, the skin gets dry. Muscle mass loss is a common occurrence as people age, and it might affect intramuscular medication absorption. Intramuscular injections may be absorbed faster; yet, because of lower peripheral blood flow, absorption may be reduced.
- **Distribution:** Drug distribution is influenced by the amount of fat, protein, and water in the body. Age-related changes lead to an increase in body fat, a loss in muscle mass and protein,

change in total body water composition. Fat-soluble drugs may stay in the body longer, increasing the danger of overdosing. Protein-binding medicines like warfarin can induce greater blood concentrations when protein levels are low. Because of the reduced body water composition, water-soluble medicines may be more active.

- **Metabolism:** As people get older, their liver mass, hepatic enzyme activity, and hepatic blood flow decrease, causing changes in medication metabolism in the liver. These modifications may cause changes in medication metabolism to an inactive form, resulting in increased exposure to an active agent and potentially harmful drug effects <sup>[11]</sup>. Drugs that are converted to an active form in the liver may have a reduced therapeutic efficacy or a delayed commencement of action.

**Table1.4 Age related changes impacting pharmacokinetics**

SL. NO	Absorption	Distribution	Metabolism	Excretion
1	Decrease in gastric motility	Increase in body fat	Decreased liver mass	Decreased renal blood flow
2	Decrease in muscle mass	Decrease in muscle mass production	Declined activity of hepatic enzymes	Decrease in renal tubular clearance
3	Decreased GI blood flow	Decrease in protein	Decreased hepatic blood flow	Decreased creatinine clearance

- **Excretion:** The pharmacologic activity of a drug is defined as the drug concentration at the target organ via pharmacodynamics. Age-related changes in effector system function, organ function, and reduced homeostatic control, as well as many simultaneous pathophysiologic alterations, affect pharmacodynamics and end-organ response. Chemotherapy efficacy and toxicity may be impacted in elderly cancer patients, who are at a higher risk of short- and long-term problems like myelosuppression, mucositis, cardiomyopathy, and peripheral neuropathy <sup>[12]</sup>.



## 1.4 ADVANTAGES AND DISADVANTAGES OF POLYPHARMACY

**Table1.3 Advantages and disadvantages of polypharmacy<sup>[12]</sup>**

SL NO	Advantages	Disadvantages
1	Prophylactic drugs counter side effects of other drugs	Higher risk of drug - drug interactions
2	Increased adherence due to lower side effects	Higher incidence of ADR's
3	Increased disease control due to multiple targets	Higher risk of non – adherence
4	Reduction in symptoms	Higher risk of medication errors
5	Benefit to society	Higher cost for the patient

### 1.1.5 MULTI MORBIDITIES

Multi morbidities are the presence of two or more long term health conditions which consist of mental conditions, disabilities, chronic pain, sensory impairment, alcohol or substance misuse. Patients with numerous chronic illnesses have a higher rate of morbidity, reduced physical functioning and quality of life, a higher risk of persistent depression, and lower social well-being. According to a WHO World Health Survey that collected data from 28 countries between 2001 and 2004, the number of people with two or more chronic illnesses, known as multimorbidity, has increased with population ageing. The existence of two chronic conditions was characterised as multimorbidity. When two or more chronic long-term diseases or ailments coexist in one patient, the number of medications given may grow<sup>[17]</sup>. Multimorbidity is linked to poorer health outcomes and greater mortality rates, as well as a significant increase in healthcare consumption and expenses<sup>[13,14]</sup>.

Polypharmacy in geriatrics is becoming a global problem due to the following factors:

1. Increased healthcare costs for senior individuals, as well as incorrect pharmaceutical prescriptions, will result in additional costs for both the patients and the healthcare system.

2. When it comes to the risk of adverse drug reactions, the risk of ADR increases as the number of medications increases; so, ADR is expected to be higher in senior patients.
3. Prescription cascade, or the addition of drugs as a result of misread ADRs, will continue to do so as long as the patient is misdiagnosed.
4. Drug-drug interactions are more likely to occur in elderly people, and the likelihood of drug-drug interactions increases as the number of prescriptions taken increases.
5. Because of the diverse and frequent regimens, elderly individuals are more likely to not adhere to their medications.

### **1.1.6 DRUG RELATED PROBLEMS ASSOCIATED WITH POLYPHARMACY**

Drugs have a vital role in geriatric health care areas for the management of the chronic and life-threatening conditions, reduction of pain and to improve the quality of life. Drug related problems consist of adverse drug reactions (ADRs), unwanted drug therapy, unsuitable selection of drugs and untreated disease conditions<sup>[15]</sup>. Polypharmacy or the multiple drug therapy have a higher risk of developing drug-drug interactions and unwanted effects particularly in geriatric population. The occurrence of ADRs will also lead to a financial burden. One of the main factors for the development of drug related problems is the age of a particular patient. Selection of unsuitable medication regimens is one of the factors. It can be resolved by improving the physician - pharmacist attention on the area of risk factor for the patient like age, disease condition and drugs<sup>[16]</sup>.

According to pharmacological classification of ADRs most common types are Type A and Type B reactions, where Type A reactions are dose dependent and unpredictable and Type B reactions are idiosyncratic reactions also known as Bizarre reactions. Most commonly occurring ADRs are under Type A reactions. The most commonly used drugs in geriatric population include antibiotics, anticoagulants, diuretics, non-steroidal anti-inflammatory agents, hypoglycaemic agents these are responsible for 60% of ADRs in hospitals<sup>[16,17]</sup>.

### **MEDICATION REVIEW IN POLYPHARMACY**

Medication review in polypharmacy is the evaluation or analysis of patient's medications with the objective of improving quality of life<sup>[18]</sup>.

### **1.1.5 POLYPHARMACY SCREENING TOOLS**

#### **1.1.5.1 WHO INDICATORS**

The Morbidity and mortality rate are increased by inappropriate use of medicines. Around half of the drugs were prescribed inappropriately, that will lead to the drug related problems and serious complications <sup>[19]</sup>. To reduce the problems WHO developed core drug use indicators for prescribing, care and studies.

The WHO indicators include

- Average number of drugs prescribed per encounter
- Percentage of drugs prescribed by generic name
- Percentage of patient encounters with an antibiotic prescribed
- Percentage of patient encounters with an injection prescribed
- Percentage of drugs prescribed from the national EDL or formulary <sup>[20]</sup>.

**Table 1.5 Derived standard values for the WHO prescribing indicators**

SL NO	INDICATORS	STANDARD VALUES
1	Average number of drugs prescribed per encounter	1.6 – 1.8
2	Percentage of patient encounters with an antibiotic prescribed	100.0
3	Percentage of patient encounters with an injection prescribed	13.4 – 24.1
4	Percentage of drugs prescribed by generic name	100.0
5	Percentage of drugs prescribed from the national EDL or formulary	100.0

**1) The average number of drugs prescribed per encounter.**

This indicator is used to determine the degree of polypharmacy. According to the World Health Organization, the average number of medications each contact should be 1.6-1.8.

*(Total number of different drug products prescribed) / (The number of encounters surveyed)*

## 2) The percentage of drugs prescribed by generic name:

This metric is used to assess the likelihood of prescribing medications having generic names.

Prescriptions for generic drugs are less expensive and have a lower risk of error. According to the WHO, all drugs in healthcare institutions should be prescribed by a generic name.

*(Number of drugs prescribed by generic name) / (Total number of drugs prescribed) x 100*

## 3) The percentage of encounters in which an antibiotic was prescribed:

The goal of this indicator is to track how much antibiotics are used in hospitals.

Antibiotic overuse has been linked to an increased risk of antibiotic resistance in geriatric patients. WHO standard is about 20-25.4%.

*(Number of patient encounters in which antibiotics was prescribed) / (Total number of encounters surveyed) x 100*

## 4) The percentage of encounters with an injection prescribed:

Calculated to measure the overall level of use of commonly overused and costly forms of drug therapy. WHO standard is, 10-17%

*(Number of patient encounters in which an injection was prescribed) / (Total number of encounters surveyed) x 100*

## 5) Percentage of drugs prescribed from an essential drug list (EDL):

Calculated to measure the degree to which practices confirm a national drug policy as indicated in the national drug list of India. WHO standard is 100%<sup>[20]</sup>.

### 1.1.5.2 BEERS CRITERIA 2019

The AGS Beers criteria is a list of medications which is unsuitable for old age people. The Beers criteria first developed by Mark H Beers in 1991 and this criterion is helpful to assess or identification of drugs that should be avoided in older age<sup>[22]</sup>. In 2011 after the death of Beers the American Geriatric Society begins to revising and updating of existing criteria, AGS will update the criteria in every 3 years started in

2012<sup>[23]</sup>. It was recently updated in 2019. This latest update includes a list of medicines that are potentially unsuitable in old age persons, medications that should be avoided with respect to conditions of patients, drugs which can be used with caution, list of drugs - drug interactions and alteration of dose according to renal function<sup>[23]</sup>.

2019 Updates :

- Medications that are potentially inappropriate in older adults
- Medications that may exacerbate a disease
- Drugs to be used with caution in older adults
- Clinically important drug interactions
- Dose reduction in renal impairment patients

### **1.1.5.3 MEDICATION APPROPRIATENESS INDEX**

MAI used as a screening tool assesses appropriateness of prescribing drugs with a 3-point rating scale of 10 item list. It will give a single score to each assessed medicine. MAI can be used to identify if the medication is suitable or not. The MAI has been used observational and interventional studies.

### **1.1.5.4 ZHAN CRITERIA**

The Zhan criteria is a makeover version of Beers criteria. This tool gives a list of drugs that should always be kept away from older persons, medications that should be used in rare situation .

### **1.1.5.5 ASSESSING CARE OF VULNERABLE ELDER-3 (ACOVE -3)**

ACOVE - 3 is a group of quality indicators for older age peoples. It is used as a guide for the decision- making process in persons with highly vulnerable risk. This tool also is concentrated in comorbidities present in old age people.

### **1.1.5.6 START / STOP CRITERIA**

START used to identify suitability of prescribed medications and STOP will be used to assess the existing medications. START includes 22 sections of criteria based on the human physiological system. STOP will focus on 65 criteria and extra things like analgesics, duplicated drug classes and medications which induce high fall risk. STOPP/START criteria for potential IP in older people recognise the dual nature of IP by including a list of PIMs<sup>[24]</sup>.

### 1.1.5.7 GOOD PALLIATIVE - GERIATRIC PRACTICE ALGORITHM

The tool was formulated to guide decisions about stopping unwanted medicines in geriatric patients. This was published by Archives of Internal Medicine.

### 1.1.6 KUPPUSWAMY SCALE FOR SOCIO ECONOMIC STATUS

The Kuppuswamy scale proposed by Kuppuswamy in 1976. It is widely used to analyze the socio-economic status of an individual based on the variables like education, income and occupation. The health condition is affected by socioeconomic status. To identify the socio-economic status of persons by using variables like Income, education, occupation etc. The SES also helps to assess the pattern of patients attending the health care settings.

The scale consists of occupation of the head, education of head of the family, total monthly income of the family, socio economic class and scores<sup>[25]</sup>. This scale divides the study population into Upper (I), Upper middle (II), Lower middle (III), Upper lower (IV) and Lower (V). Each variable in this scale is analysed and give corresponding scores then the total score is summed and classifies the individuals.

### 1.1.7 PHARMACOECONOMICS

Pharmacoeconomics is a branch of health economics deals with identifying, measuring, and comparing the costs and consequences of pharmaceutical products and services. pharmacoeconomic analysis consists of cost minimization analysis, cost effectiveness analysis, cost benefit analysis and cost utility analysis. Proper application of Pharmacoeconomics will give the health care practitioners and administrators to make better and more informed decisions regarding products and services they provide<sup>[27]</sup>.

Components of Pharmacoeconomics:

1. Economic
  - Cost benefit
  - Cost effectiveness
  - Cost minimization
  - Cost utility
2. Humanistic
  - Quality of life
  - Patient preferences
  - Patient satisfaction

Cost of the drugs are increased according to the release of new medications in the market. Many factors that contribute price of drug.

- The sector which medicines are purchased so the price was higher in private hospital care settings
- The types of procurement, different prices be paid for same product
- The distribution routes

## NEED OF PHARMACOECONOMICS

Pharmacoeconomics identify the measures and compares the cost of pharmaceuticals and describe the economic relationship. All over the world persons have burden due to the high cost of medicines. Peoples under poor economic criteria face this problem buying medicines and food.

The first step in the analysis of cost is the identification of various costs.

1. **DIRECT COST** : It includes staff costs, capital costs, drug acquisition, physicians' fees, cost of administering the medication, costs of treating an adverse drug reaction, etc.
2. **INDIRECT COST** : Cost of respective society. For example, these might include loss of earnings, loss of productivity, loss of leisure time, due to the illness, and cost of travel to hospital etc.
3. **INTANGIBLE COST**: The pain, worry or other distress; which a patient or their family might suffer. These may be impossible to measure in monetary terms, but are sometimes captured in measures of quality of life<sup>[27]</sup>.

The cost can be measured in following ways:

- Cost / unit
- Cost / treatment
- Cost / person
- Cost / person / year
- Cost / case prevented

### 1.1.8 ECONOMIC BURDEN DUE TO POLYPHARMACY

Drug induced problems significantly cause clinical and economic burden on patient and also in healthcare system. The polypharmacy also will induce the socio-economic burden. In elderly patients, polypharmacy was linked to a roughly doubled rise in health-care spending and a tripled increase in pharmacy spending. Polypharmacy was linked to higher overall health-care spending, higher total pharmacy-related spending,



and higher non-pharmacy-related spending. Polypharmacy is linked to nearly double the overall health-care spending and three times the pharmacy spending<sup>[29]</sup>.

**Table1.5 Negative impact of polypharmacy**

<b>Patient</b>	<b>Health care system</b>
Decreased quality of life	Increased medication errors
Increased morbidity	Increased burden of health care system
Risk of adverse drug reactions	Decreased physician productivity
Increased use of health care systems	Decreased quality of care

### **1.1.9 PREVENTION OF POLYPHARMACY INTERVENTIONS TO REDUCE POLYPHARMACY**

A large amount of studies is available regarding the evidence-based interventions to reduce multiple use of

drugs, unsuitable prescribing, and patient non-adherence<sup>[29,30]</sup>. The polypharmacy assessment tools and guidelines are also mainly targeted on the geriatric population. The themes to reduce polypharmacy include the interventions :

- Mark appropriates versus inappropriate prescribing
- Build up proper patient education about disease and medications
- Strengthen patient - physician communication
- Care must be taken in high-risk areas such as transitions of care
- Increase interprofessional collaboration
- Reduce non-adherence in patients

## 2.LITERATURE REVIEW

### 2.1 PREVALENCE OF POLYPHARMACY

**Mina Khezrian, SAGE Journals, An overview of prevalence, determinance and health outcomes of polypharmacy, 2020.** The study showed that the prevalence of polypharmacy varied between 10% to as high as around 90% in different populations. Chronic conditions, demographics, socioeconomics, and self-assessed health factors were independent predictors of polypharmacy.

**Rushab J Dagli, Journal of International Oral health International Society of Preventive and community Density. Polypharmacy: A Global Risk Factor for Elderly People.** Studies have shown that on an average 2-9 medications per day are taken by the elderly people. The prevalence of inappropriate medication used by the elderly people was found to be from 11.5-62.5%.

**Emily R Hajjar, The American Journal of Geriatric Pharmacotherapy. Polypharmacy in Elderly Patients,2007.** This study investigated that polypharmacy continues to increase and is a known risk factors of morbidity and mortality. Various studies globally have shown that on average 2-9 medications per day are taken by elderly people. The prevalence of inappropriate medication used by elderly people was found to be from 11.5-62.5%

**Akshaya S Bhagavathulla, Frontiers in Pharmacology. Prevalence of Polypharmacy, Hyper polypharmacy and Potentially Inappropriate Medication Use in Older Adults in India: A Systematic Review and Meta-Analysis.** The prevalence of PIM use in adults aged  $\geq 70^{\circ}$  years was 35% (28-42), in those taking more medications ( $\geq 5.5/\text{day}$ ) was 27% (22-31), and in adults using a high number of PIMs ( $\geq 3$ ) was 29% (22-36). Subgroup analysis showed that cross-sectional studies had a higher pooled prevalence of polypharmacy 55% (44-65) than cohorts 45% (37-54). Hyper polypharmacy in inpatient care settings was 37% (26-47), whereas PIM use was higher in private hospitals 31% (24-38) than government hospitals 25% (19-31).

**Mohammed S.S, Indian Journal of Pharmacy Practice. The Prevalence of Polypharmacy in South Indian Patients: A Pharmacoepidemiological Approach.2012.** The use of medication for disease conditions is necessary, but an unnecessary load of drugs to patients 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 the 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 the cost of therapy.

## 2.2 INAPPROPRIATE USE OF MEDICATIONS AND POLYPHARMACY

**Michael A. Steinman M D, Journal of the American Geriatric Society, Polypharmacy and Prescribing Quality in Older People, 2021.** The study suggests that, Inappropriate medication use and underuse were common in older people taking five or more medications. Inappropriate medication use and underuse were common in older people taking 5 or more medications, with both simultaneously present in more than 40% of patients.

**Maryann M. Fulton RN, Journal of the American Academy of Nurse Practitioners. Polypharmacy in Elderly. 2005.** Results of the literature review revealed that polypharmacy continues to be a significant issue and little research has been conducted regarding the methods primary care providers utilize to assess polypharmacy. This study identified 48 individual medications or classes of medications to avoid in older adults and their potential concerns and 20 diseases or conditions and medications to be avoided in older adults with these conditions of these potentially inappropriate drugs, 66 were considered by the panel to have adverse outcomes of high severity.

**Donna M Fick, JAMA Internal Medicine. Updating the Potentially Inappropriate Medication Use in Older Adults. 2003.** The study shows that major polypharmacy is more prevalent in males of age group 65 and above.

**Ronald B Stewart, Springer Link, Polypharmacy in the Aged, 2012.** Studies conducted in a variety of settings have shown that patients over 65 years of age use an average of 2 to 6 prescribed medications and 1 to 3.4 nonprescribed medications

## 2.3 PRESCRIBING INDICATORS IN GERIATRIC PATIENTS

**Benjamin J Basgar, Springer Link, Inappropriate Medication Use and Prescribing Indicators in Elderly Australians. 2012.** The study found that, a prescribing indicators tool was developed. Forty-eight prescribing indicators were identified, consisting mainly of optimum as well as inappropriate medication choices for a large number of common medical conditions in the elderly.

## SIGNIFICANCE OF THE STUDY

The demographic transition in the elderly population can constitute a significant challenge for health authorities as with advancing age can leads to multiple chronic diseases such as diabetes mellitus, hypertension, chronic heart disease, renal disease etc are associated. Thus, as a result the elderly patients tends to take multiple medications in a day and is called as polypharmacy.

In older age total body water and muscle mass decrease while percentage of body fat increases similarly, a drastic change in pharmacokinetics can also be noticed. This may result reduced drug metabolism in the body. Geriatric patients are at greater risk for drug related problems because of the metabolic changes and reduced drug clearance associated with ageing. This risk gets more complicated by increasing the number of drugs used. thus, it is said that geriatric group of people are vulnerable to drug interactions due to multiple drug therapies.

Polypharmacy is an area of concern for several reasons. Elderly patients are higher risk in ADR because of metabolic changes and reduced drug clearance associated with ageing, potential drug-drug interactions can be furthermore exacerbated by multiple use of drugs. Polypharmacy may lead to decreased medication compliances ,poor quality of life, and unnecessary drug expenses.

WHO developed core and complementary drug use indicators for evaluation of drug use in healthcare settings. Among which, the core drug use indicators have been considered as the first line indicators validated by WHO for measurement of drug use. The core drug use indicators are more informative, more feasible, less likely to fluctuate over time and place as well as easier to measure drug use than the complementary indicators . Therefore, the core indicators have been selected for better quantitative evaluation of RDU.

The socio-economic status of the patients was analyzed and the direct and indirect cost of the patient in the hospital stay. The use of WHO indicators, effective therapeutic drug monitoring, and a comprehensive, periodic review of the patient's medication list will help to avoid the potentially lethal complications of polypharmacy. This study provides some information's about the prevalence of polypharmacy and access the pattern of prescription in geriatric population.

## AIM AND OBJECTIVES

### AIM

- To assess the pattern of prescription, prevalence and economic impact of polypharmacy in geriatric population.

### OBJECTIVES

- To assess the diagnostic pattern of geriatric population.
- To assess the pattern of prescription using selected WHO drug use indicators.
- To assess the prevalence of geriatric polypharmacy.

## 5. METHODOLOGY

### 5.1 STUDY AREA OR SETTINGS

The study was conducted among Geriatric population admitted in NIMS Medicity Neyyattinkara. It is a tertiary care hospital with over 350 Inpatient beds.

### 5.2 STUDY POPULATION

Geriatric patient who is getting inpatient treatment at NIMS Medicity for various diseases.

### 5.3 SAMPLE SIZE

The sample size at 95% confidence interval is 138.

$p$  = expected proportion in population based on previous study  $q = 1 - p$

$d$  = absolute error on precision (5%)  $z = z$  score (1.96)

sample size =  $\frac{z^2 p(1-p)}{d^2}$

$d^2$

$$S = (1.96)^2 * (0.5)(1-0.5) / 5^2$$

$$= 138 \text{ samples}$$

Based on the above equation sample size was calculated as 138.

The study sample was calculated based on the study reference given below,

**Khezrian, M., McNeil, C., Murray, A. and Myint, P., 2020. An overview of prevalence, determinants and health outcomes of polypharmacy. *Therapeutic Advances in Drug Safety*, 11, p.204209862093374.**

**5.4 STUDY DESIGN:** A hospital based cross-sectional study.

## 5.5 CRITERIA FOR PATIENT SELECTION

### 5.5.1 INCLUSION CRITERIA

- Geriatric subjects who were seeking treatment at NIMS hospital for various disease/disorder and willing to participate.
- Both genders were included.
- Those who understood the purpose of the study and were ready to provide information regarding their health status and those who signed on informed consent documentation.

### 5.5.2 EXCLUSION CRITERIA

- Not willing to participate.
- Those unable to comprehend for other reasons, mentally unstable and memory impairment.
- Those are admitted for surgery.
- Those having any health insurance.

## 5.6 SAMPLING TECHNIQUE

- Judgmental sampling Technique was used. The first patient was recruited after obtaining ethical committee approval.

## 5.7 STUDY DURATION

- The prospective observational study was carried out for over a period of 6 months commencing from December 2021 to May 2022

## 5.8 STUDY VARIABLES

- **Patient demographic details and clinical characteristic details-** It includes name, age, sex, height, weight, religion, family history, social history, education, occupation, monthly income, final diagnosis, duration of illness, marital status, employment, duration of illness, medical history, medication history, usage of OTC and history of drug allergy.
- **Socioeconomic status:** The socioeconomic factors that determine health include: (occupation, education, monthly income) using the Modified Kuppaswamy Socio-economic Scale.
- **Cost of illness due to polypharmacy:** (direct medical cost includes the cost of drugs, laboratory cost etc., direct non-medical cost includes travel cost, cost of food, accommodation etc., indirect non-medical costs like the patient and bystander salary loss).



## • WHO INDICATORS

1. Average number of drugs prescribed per encounter was calculated to measure the degree of polypharmacy.

*(Total number of different drug products prescribed) / (The number of encounters surveyed)*

2. Percentage of drugs prescribed by generic name is calculated to measure the tendency of prescribing by generic name.

*(Number of drugs prescribed by generic name) / (Total number of drugs prescribed) x 100.*

3. Percentage of encounters in which an antibiotic was prescribed was calculated to measure the overall use of commonly overused and costly forms of drug therapy.

*(Number of patient encounters in which antibiotics was prescribed) / (Total number of encounters surveyed) x 100*

4. Percentage of encounters with an injection prescribed was calculated to measure the overall level use of commonly overused and costly forms of drug therapy.

*(Number of patient encounters in which an injection was prescribed) / (Total number of encounters surveyed) x 100*

5. Percentage of drugs prescribed from an essential drug list (EDL) was calculated to measure the degree to which practices conform to a national drug policy as indicated in the national drug list of India.

*(Number of products prescribed in essential drug list) / (Total number of drugs prescribed) x 100*

## 5.9 ETHICAL CONSIDERATION

The study was approved on 30<sup>th</sup> April 2021 by the ethics committee of NIMS Medicity, Neyyattinkara and was certified by the Institutional Ethics Committee and approved the proposal with an IEC approval number [ECR EC/NEW/INST/2022/KL/0068].

## 5.10 BUDGET

The entire expense of the study was met by the student investigators.

## 5.11 DATA COLLECTION AND ANALYSIS

- The data collection form includes details on patient's demographics, reason for admission, education, occupation, income, past medical history, past medication history, final diagnosis, treatment chart (drugs prescribed in brand form, drugs prescribed in generic form, route of administration, dosage form, duration of hospital stay).
- Data were obtained in a systematic manner utilizing a data collection form.
- The data was collected from the patient's files of inpatients with 5 or more medications prescribed in the treatment chart.
- Information regarding the study (patient demographics, education, occupation, monthly income, transportation cost, cost of meals, loss of income due to hospitalization) was collected by interviewing the patients, and patient caregivers.
- Type of polypharmacy was also analyzed including same class polypharmacy, multiclass polypharmacy, adjunctive polypharmacy, augmented polypharmacy from the prescribed drugs of treatment chart.
- The Modified Kuppuswamy Socio-economic scale was used to assess socioeconomic status.
- Adverse drug reactions of the prescribed drugs are also analyzed, route of administration, management of ADR are also analyzed
- Cost of illness was calculated by interviewing the patients on direct medical and non-medical costs, including the cost of drugs, cost of laboratory test, cost of transportation, cost of rent, cost of food, and indirect non-medical costs like patient and bystander loss of wages.
- After the collection of data, it was recorded and analyzed using an MS Excel spreadsheet and “R” software.

## **5.12 DESCRIPTION OF TOOLS USED**

- Data collection form- is a way of recording approach to obtaining the data that are needed to perform the analysis.
- Modified Kuppuswamy socioeconomic scale-used to measure socioeconomic status in urban and rural areas.

## **5.13 DISSEMINATION**

- After the study period the thesis will be submitted to KERALA UNIVERSITY OF HEALTH SCIENCES, Thrissur for project evaluation as a part of the Fifth year PharmD academic purpose.

## 6. RESULT AND DISCUSSIONS

### 6.1 PATIENT DEMOGRAPHIC DETAILS

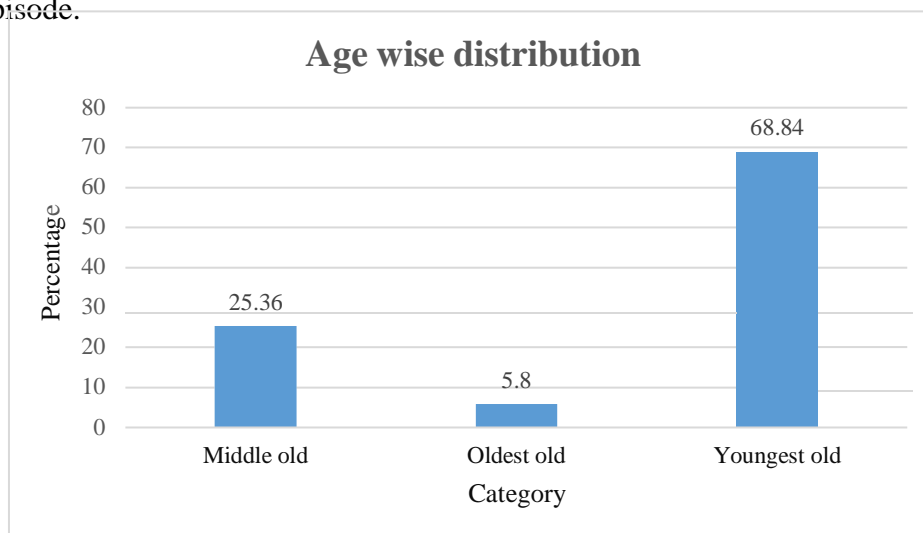
#### 6.1.1 AGE-WISE DISTRIBUTION

Among 138 patients, age was categorized into three groups: 65-74 (youngest old) (68.84%, N=95), 75-84 (middle old) (25.36%, N=35), <85 (oldest-old) (5.80%, N=8). The most prominent age group comes under between 65-74yrs (68.84%, N=95). The mean age of the patient involved was 69.5.

**Table 6.1.1** Frequency and percentage distribution of samples according to age.

AGE	FREQUENCY(N)	PERCENTAGE (%)
Youngest Old	95	68.84
Middle Old	35	25.36
Oldest Old	8	5.80

This is because patients in this age group were often admitted to the hospital. Similar result was found in the study conducted by *Mubarak N Ameri et al*<sup>[87]</sup>. It was indicated that 89% of elderly patient mostly aged from 60-79 years old, were taking more than the 5 medications and were exposed to one polypharmacy episode.



**Fig 6.1.1** Bar diagram showing distribution of age.

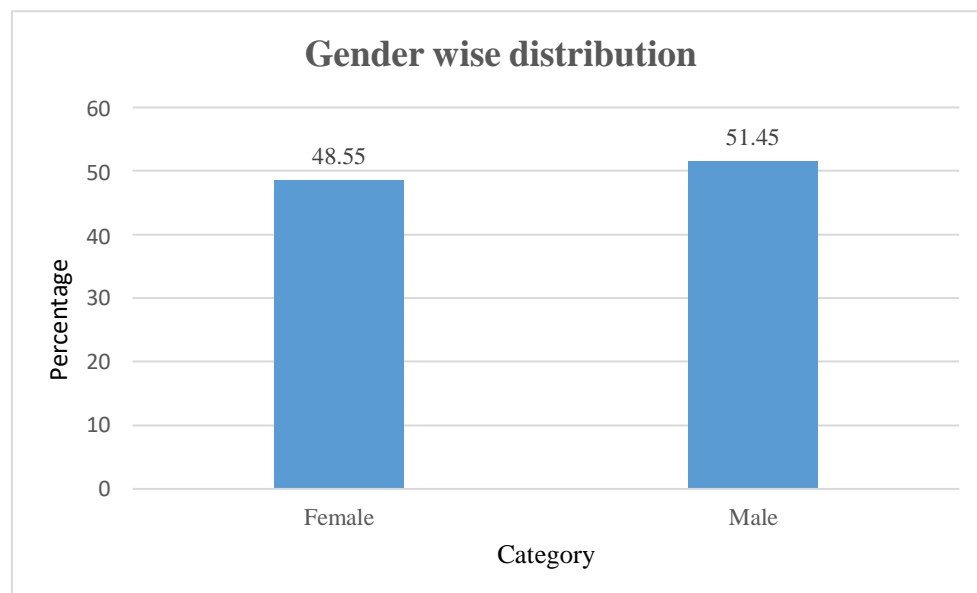
### 6.1.2 GENDER WISE DISTRIBUTION

Out of 138 patients, 51.45%(N=71) were males and 48.55%(N=67) were females. Male gender was found to be higher rate than females.

**Table 6.1.2 Frequency and percentage distribution of samples according to gender.**

AGE	FREQUENCY(N)	PERCENTAGE (%)
Male	71	51.45
Female	67	48.55

Similar result was found in the study conducted by *Mubarak N Ameri et al* <sup>[87]</sup>. were elderly males (56%) were exposed to polypharmacy than females (44%). However, some studies from the literature had shown that there is no associations b/w polypharmacy and gender.



**Fig 6.1.2 Bar diagram showing distribution of gender.**

### 6.1.3 DISEASE WISE DISTRIBUTION

Among 138 patients, 10.87% (N=15) found to be Stroke, 7.25% (N=10) COPD exacerbation, 5.80% (N=8) Diabetic Foot Ulcer, 5.80% (N=8) Gastritis, 5.80% (N=8) Cellulitis, 5.07% (N=7) Asthma, 3.62% (N=5) UTI, 2.90% (N=4) Hernia, 2.90% (N=4) Pulmonary Edema, 2.17% (N=3) Bronchitis, 2.17% (N=3) LRTI, 2.17% (N=3) Cirrhosis, 2.17% (N=3) Anemia, 2.17% (N=3) Seizure, 2.17% (N=3) CLD, 2.17% (N=3)

Cancer. The most patients come under disease stroke (10.87%) followed by COPD exacerbation (7.25%),

Diabetic Foot Ulcer (5.80%), Cellulitis (5.80%), Asthma (5.07%), UTI (3.62%), Hernia (2.90%), Pulmonary

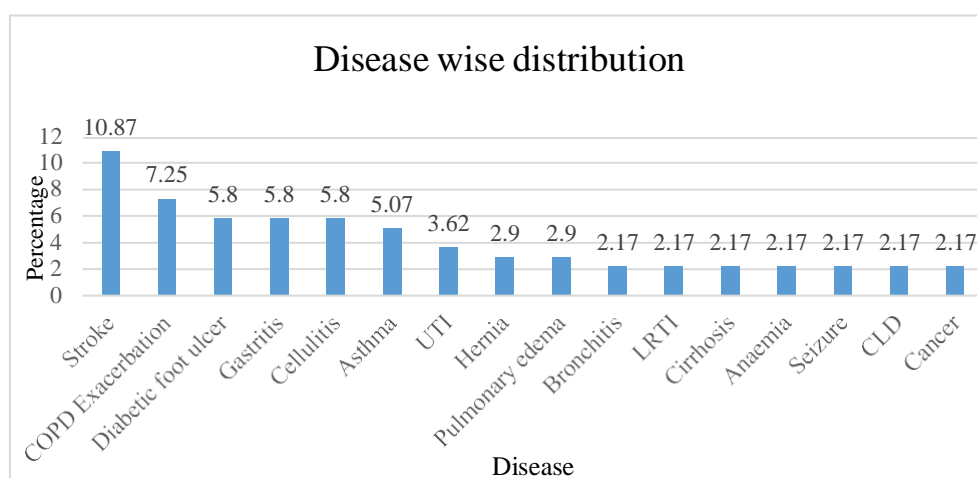
Edema (2.90%), Bronchitis (2.17%), LRTI (2.17%), Cirrhosis (2.17%), Anemia (2.17%), Seizure (2.17%),

CLD (2.17%), Cancer (2.17%).

**Table 6.1.3 Frequency and percentage distribution of samples according to diseases.**

DISEASE	FREQUENCY(N)	PERCENTAGE (%)
Stroke	15	10.87
COPD Exacerbation	10	7.25
Diabetic Foot Ulcer	8	5.80
Gastritis	8	5.80
Cellulitis	8	5.80
Asthma	7	5.07
UTI	5	3.62
Hernia	4	2.90
Pulmonary Edema	4	2.90
Bronchitis	3	2.17
LRTI	3	2.17
Cirrhosis	3	2.17
Anemia	3	2.17
Seizure	3	2.17
CLD	3	2.17
Cancer	3	2.17

In our study, the patients come under disease Stroke (10.87%) was higher. Similar to *Sangharshila et al* <sup>[88]</sup>, were the most prevalent diseases from circulatory system (60%) and those with ischemic heart diseases and CVA.



**Fig 6.1.3 Bar diagram showing disease wise distribution**

## 6.1.4 DISTRIBUTION OF AGE AGAINST DISEASE

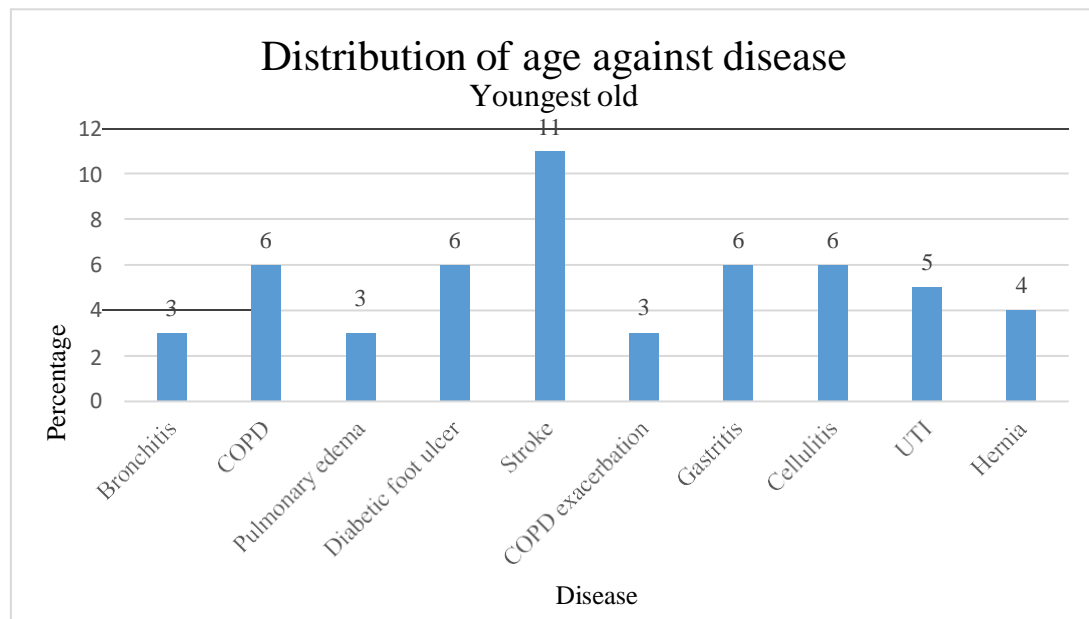
### 6.1.4.1 DISTRIBUTION OF YOUNGEST OLD AGAINST DISEASE

About 138 patients, 95 were youngest old (65-74yrs), Stroke (11.57%,N=11), COPD (6.31%,N=6), Diabetic Foot Ulcer (6.31%,N=6), Gastritis (6.31%,N=6), Cellulitis (6.31%,N=6), UTI (5.26%,N=5), Hernia (4.21%, N=4), Bronchitis (3.15%, N=3), Pulmonary Edema (3.15%, N=3), COPD Exacerbation (3.15%, N=3), STEMI (2.10%, N=2), Asthma (2.10%, N=2), LRTI (2.10%, N=2), Cirrhosis (2.10%, N=2), Peptic Ulcer (2.10%, N=2), Cholelithiasis (2.10%, N=2), AKI (2.10%, N=2), CLD (2.10%, N=2), Vertigo (2.10%, N=2), Kidney Stone (2.10%, N=2).

**Table 6.1.4 Frequency and Percentage of youngest old Diseases**

DISEASE	FREQUENCY(N)	PERCENTAGE (%)
Stroke	11	11.57
COPD	6	6.31
Diabetic Foot Ulcer	6	6.31
Gastritis	6	6.31
Cellulitis	6	6.31
UTI	5	5.26
Hernia	4	4.21
Bronchitis	3	3.15
Pulmonary Edema	3	3.15
COPD Exacerbation	3	3.15
STEMI	2	2.10
Asthma	2	2.10
LRTI	2	2.10
Cirrhosis	2	2.10
Peptic Ulcer	2	2.10
Cholelithiasis	2	2.10
AKI	2	2.10
CLD	2	2.10
Vertigo	2	2.10
Kidney Stone	2	2.10





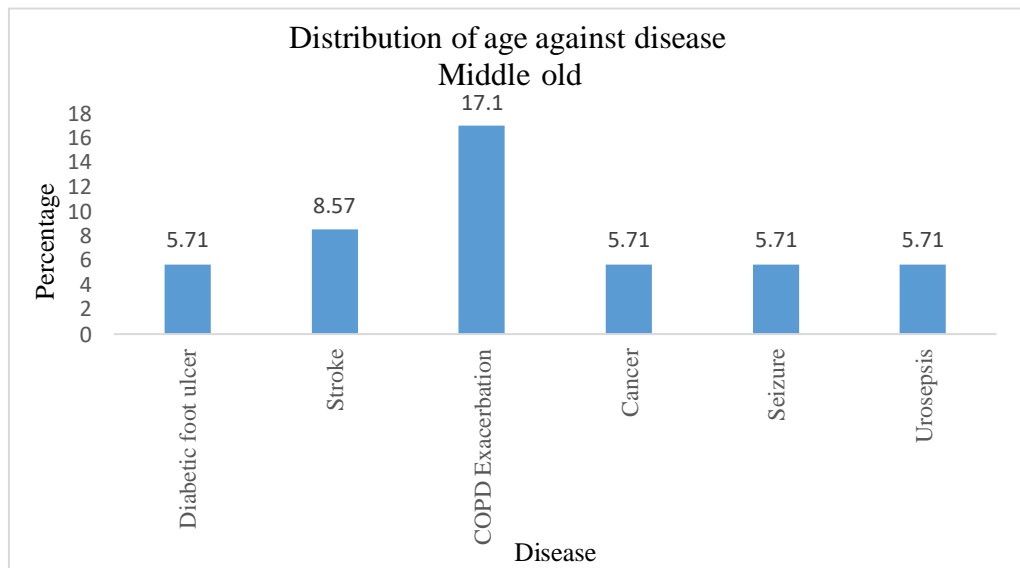
**Fig 6.1.4 Bar diagram showing distribution of youngest old age against disease.**

#### **6.1.4.2 DISTRIBUTION OF MIDDLE OLD AGAINST DISEASE**

Out of 138 patients 35 were middle old (75-85yrs), COPD Exacerbation (17.1%, N=6), Stroke (8.57%, N=3), Diabetic Foot Ulcer (5.71%, N=2), Cancer (5.71%, N=2), Seizure (5.71%, N=2), Urosepsis (5.71%, N=2). The most patient come under disease found to be COPD Exacerbation (17.1%) followed by Stroke (8.57%), Diabetic Foot Ulcer (5.71%), Cancer (5.71%), Seizure (5.71%), Urosepsis.

**Table 6.1.4.2 Distribution of frequency and percentage middle old against disease**

DISEASE	FREQUENCY(N)	PERCENTAGE (%)
COPD Exacerbation	6	17.1
Stroke	3	8.57
Diabetic Foot Ulcer	2	5.71
Cancer	2	5.71
Seizure	2	5.71
Urosepsis	2	5.71



**Fig 6.1.4.2 Bar diagram showing distribution of middle old age against diseases**

#### 6.1.4.3 DISTRIBUTION OF OLDEST OLD AGE AGAINST DISEASE

Out of 138 patients 8 of them are in oldest old category(<85yrs), Pulmonary Edema (12.5%, N=1), Anaemia (12.5%, N=1), Stroke (12.5%, N=1), COPD Exacerbation (12.5%, N=1), CLD (12.5%,N=1), Gastritis (12.5%,N=1), Cellulitis (12.5%,N=1), Electrolyte Imbalance (12.5%,N=1). The most patient comes under disease found to be Pulmonary Oedema (12.5%), Anaemia (12.5%), Stroke (12.5%), COPD Exacerbation (12.5%), CLD (12.5%), Gastritis (12.5%), Cellulitis (12.5%), Electrolyte Imbalance (12.5%).

**Table6.1.4 Distribution of frequency and percentage oldest old against disease**

DISEASE	FREQUENCY(N)	PERCENTAGE (%)
Pulmonary Edema	1	12.5
Anemia	1	12.5
Stroke	1	12.5
COPD exacerbation	1	12.5
CLD	1	12.5
Gastritis	1	12.5
Cellulitis	1	12.5
Electrolyte Imbalance	1	12.5

It was similar to the study conducted by *kameel Mungrue et al* <sup>[77]</sup>. were the mean age of stroke was

found in age of 65-75 (youngest old) Ischemic stroke was the most frequent sub type, highest occurrence of stroke was 29.2%. It was contrary to the study conducted by *Bumheeyang et al* <sup>[81]</sup> were prevalence of bronchitis

was higher than COPD because the patients have the history of pulmonary infection and pulmonary tuberculosis, similar study was conducted by *Bassam Mahboub et al* <sup>[83]</sup> found that 91 % of participants in the study have COPD.

## 6.1.5 DISTRIBUTION OF DISEASE ON GENDER

### 6.1.5.1 FREQUENCY AND PERCENTAGE DISTRIBUTION OF DISEASE AGAINST MALE

Out of 138 patients 71 are males, Stroke (15.4%, N=11), COPD Exacerbation (8.45%, N=6), Diabetic Foot Ulcer (7.04%, N=5), Cirrhosis (4.22%, N=3), CLD (4.22%, N=3), Gastritis (4.22%, N=3), Cellulitis (4.22%,

N=3), STEMI (4.22%, N=3), Bronchitis (4.22%, N=3), STEMI (4.22%, N=3), Bronchitis (4.22%, N=3),

Pulmonary Oedema (4.22%, N=3), Variceal Bleeding (4.22%, N=3), cancer (4.22%, N=3), Hernia (4.22%, N=3), Kidney Stone (4.22%, N=3). The most common disease in males is found to be Stroke (15.4%), followed by COPD exacerbation (8.45%), Diabetic Foot Ulcer (7.04%), Cirrhosis (4.22%), CLD (4.22%),

Gastritis (4.22%), Cellulitis (4.22%), STEMI (4.22%), Bronchitis (4.22%), STEMI (4.22%), Bronchitis

(4.22%), Pulmonary Oedema (4.22%), Variceal Bleeding (4.22%), Cancer (4.22%), Hernia (4.22%), Kidney

Stone (4.22%).

**Table 6.1.5.1 Frequency and percentage distribution of disease on gender(males)**

DISEASE	FREQUENCY(N)	PERCENTAGE (%)
Stroke	11	15.4
COPD Exacerbation	6	8.45
Diabetic Foot Ulcer	5	7.04
Cirrhosis	3	4.22
CLD	3	4.22
Gastritis	3	4.22
Cellulitis	3	4.22
STEMI	2	2.81

Bronchitis	2	2.81
Pulmonary Edema	2	2.81
Variceal Bleeding	2	2.81
Cancer	2	2.81
Hernia	2	2.81
Kidney Stone	2	2.81

Similar study was conducted by *Ashraf Alzaabi et al.*<sup>[91]</sup> found that prevalence of stroke was higher in male (44.29%) than females because men have the high blood pressure and overweight, presence of diabetes and habit of smoking can be higher, a contrary study by *Mathew j et al.*<sup>[86]</sup> showed that women are higher risk of stroke than men because women have more events and are less likely to recover. Age specific disease are higher in men but because of their long-life expectancy and much higher incidence at older age, females have more stroke than males.

#### 6.1.5.2 FREQUENCY AND PERCENTAGE DISTRIBUTION OF DISEASE AGAINST FEMALE

Out of 138 patients 67 were females, COPD (8.95%, N=6), Gastritis (7.46%,N=5), Cellulitis (7.46%,N=5), UTI (7.46%,N=5), Stroke (5.97%,N=4), COPD Exacerbation (5.97, N=4), Diabetic Foot Ulcer (4.47,N=3), Pulmonary Edema (2.28%, N=2), LRTI (2.28%, N=2), Anemia (2.28%, N=2), Hyponatremia (2.28%, N=2), Vertigo (2.28%, N=2), Hernia (2.28%, N=2), Seizure (2.28%, N=2). The most common disease among

females was found to be COPD (8.95%) followed by Gastritis (7.46%), Cellulitis (7.46%), UTI (7.46%),

Stroke (5.97%), COPD Exacerbation (5.97), Diabetic Foot Ulcer (4.47), Pulmonary Edema (2.28%), LRTI

(2.28%), Anemia (2.28%), Hyponatremia (2.28%), Vertigo (2.28%), Hernia (2.28%), Seizure (2.28%).

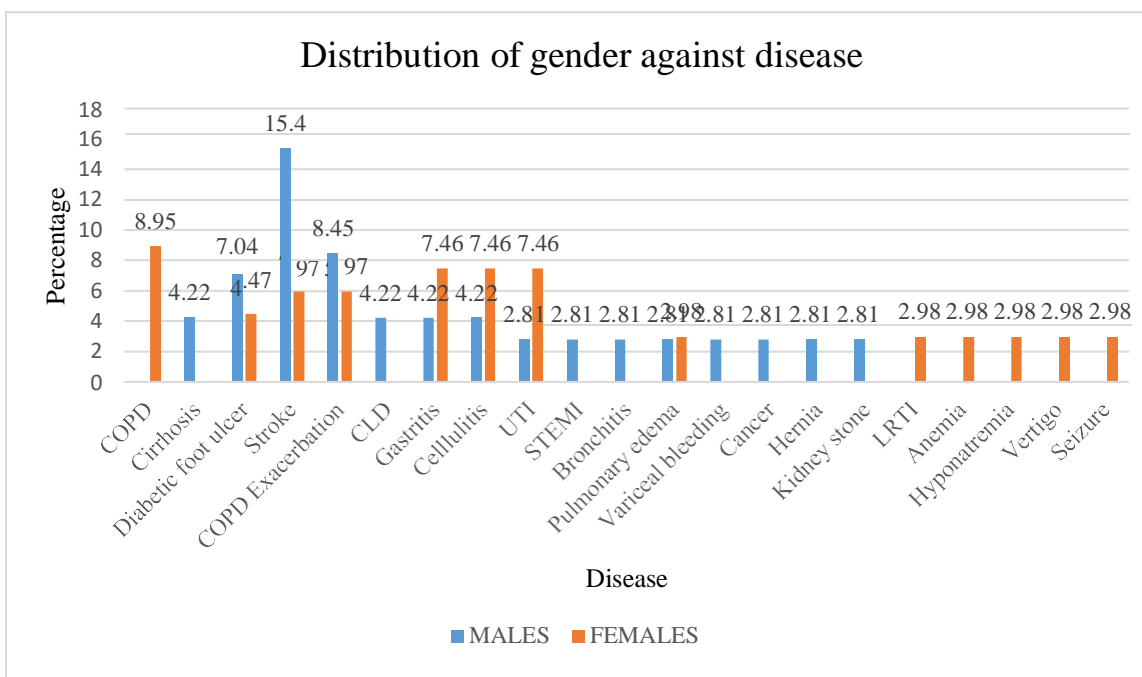
**Table 6.1.5.2 Frequency and percentage distribution of disease on gender (Females)**

DISEASE	FREQUENCY(N)	PERCENTAGE (%)
COPD	6	8.95
Gastritis	5	7.46
Cellulitis	5	7.46
UTI	5	7.46
STROKE	4	5.97
COPD exacerbation	4	5.97
Diabetic Foot Ulcer	3	4.47
Pulmonary Edema	2	2.98
LRTI	2	2.98
Anemia	2	2.98
Hyponatremia	2	2.98
Vertigo	2	2.98
Hernia	2	2.98
Seizure	2	2.98

In our study female were found to be more likely to COPD, similar study was conducted by *Christin R Jenkins et al.*<sup>[69]</sup> the prevalence of COPD increasing more rapidly in females and also hospitalization

was increased compared to males. Women have the risk of developing COPD are biomass fuel exposure, occupational exposure, respiratory infections, hyper responsiveness and low socioeconomic status. Biological factors and anatomy play an important role in the female risk of COPD. Women usually have

smaller lungs than men. Hence irritants like cigarette or workplace dust and fumes enter into the lungs at higher concentration. Down the road these substances cause higher risk of COPD in females.



**Fig 6.1.5 Bar diagram showing distribution of gender against diseases**

### 6.1.6 DISTRIBUTION OF SOCIOECONOMIC STATUS

Out of 138 patients, 2.17% (N=3), 19.57% (N=27), 28.26% (N=39), 42.75% (N=59) and 7.25% (N=10)

were Upper, Upper Middle, Lower Middle, Upper Lower and Lower Middle respectively. The most of the patients presented with polypharmacy were from Upper Lower Class (42.75%, N=59), followed by Lower Middle Class (28.26%, N=39).

**Table 6.1.6 Frequency and percentage distribution of samples according to Socio-economic status.**

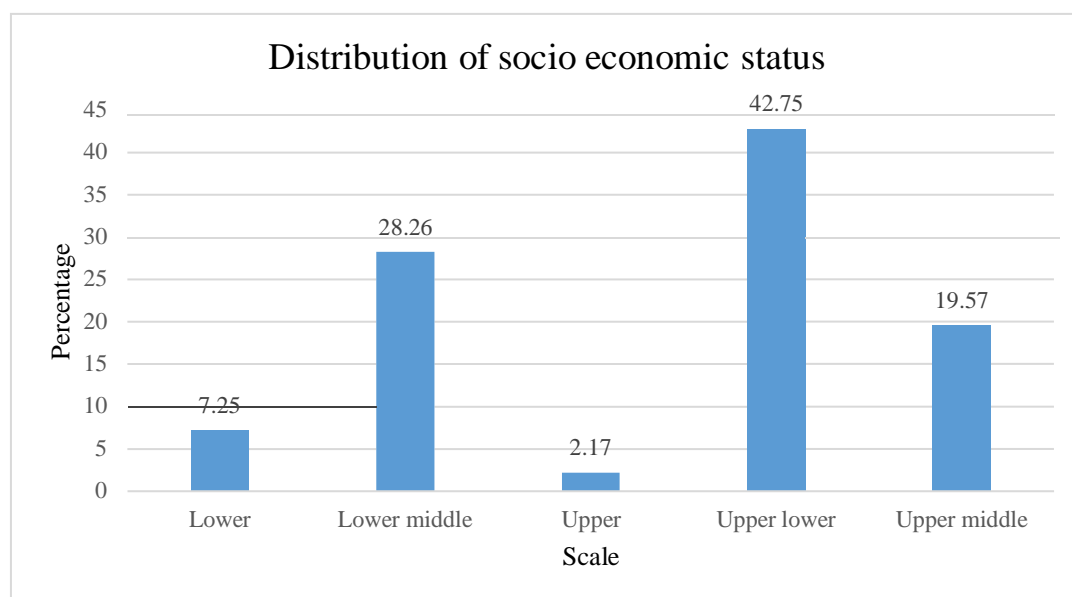
SOCIO-ECONOMIC STATUS	FREQUENCY (N)	PERCENTAGE (%)
Upper	3	2.17
Upper middle	27	19.57
Lower middle	39	28.26
Upper lower	59	42.75
Lower	10	7.25

The modified Kuppaswamy scale was used to find out the living status of patients based on education, occupation, and income, in our study majority of the study population belongs to class IV of the Kuppaswamy scale upper lower class, similar study was conducted by *Priyadarisini et al<sup>[99]</sup>* found



that around 70% of study population belonged to class IV of Kuppaswamy scale; upper lower class, Because the

upper lower class accounts for a sizable portion of the Indian population, and also multispecialty hospitals are mostly accessible to affluent families hence, the patients will be more from the upper-middle. Despite the fact that the study was conducted in a rural context where the region is primarily owned by the upper lower class.



**Fig 6.1.5 Bar diagram showing the distribution of socio-economic status.**

### 6.1.7 DISTRIBUTION OF SOCIO-ECONOMIC STATUS AGAINST AGE.

Among 138 patients, 1.45% (N=2), 14.49% (N=20), 21.74% (N=30), 26.09% (N=36), 5.07% (N=7) from

Upper, Upper-Middle, Lower Middle, Upper Lower, and Lower belong to the age group of youngest old (65-74) years. 0.72% (N=1), 2.90% (N=4), 5.07% (N=7), 14.49% (N=20), 2.17% (N=3) from Upper, Upper-

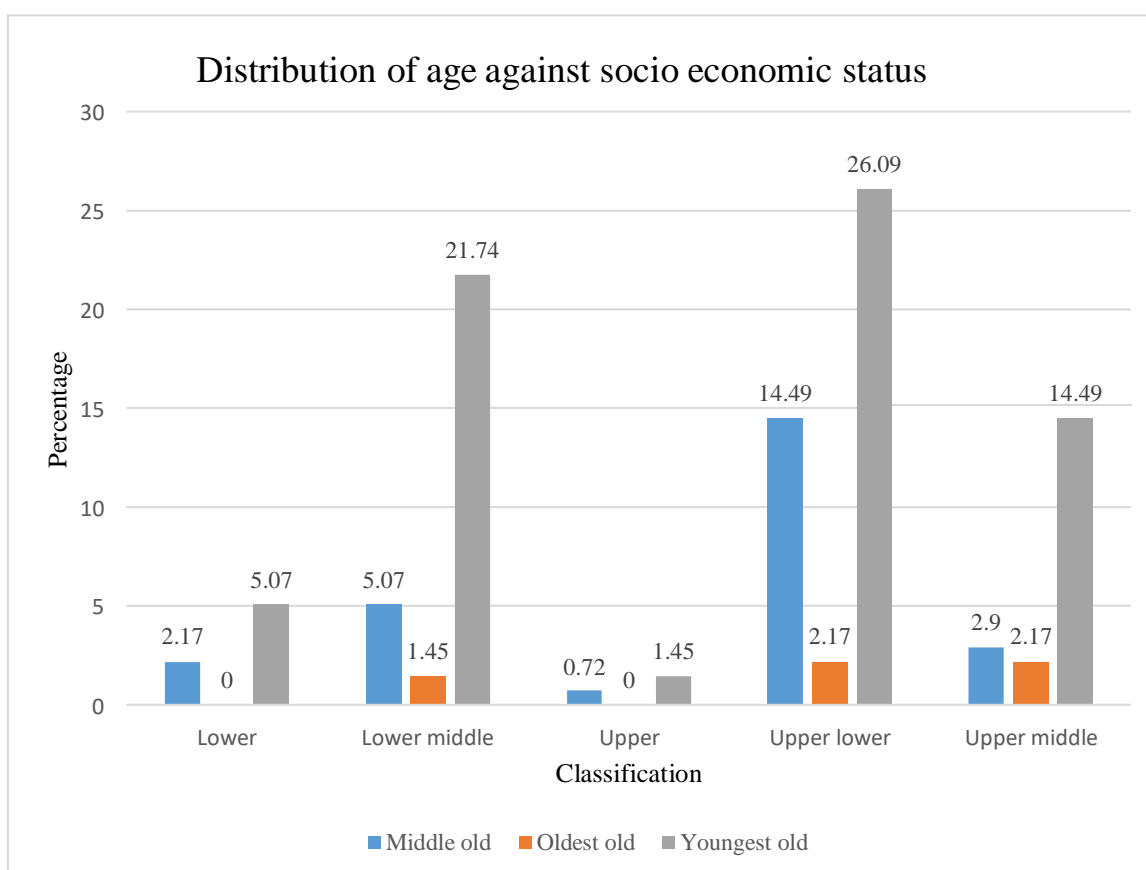
Middle, Lower-Middle, Upper Lower belong to the age group of middle old (75-85) years. 2.17% (N=3), 1.45% (N=2), and 3% (N=2.17), from Upper-Middle, Lower Middle, and Upper Lower belong to the age group of oldest-old (<85) years.

**Table 6.1.7 Frequency and percentage distribution of socio-economic status against age.**

SOCIO-ECONOMIC CLASS	AGE					
	YOUNGEST OLD		MIDDLE OLD		OLDEST OLD	
	N	%	N	%	N	%
Upper	2	1.45	1	0.72	0	0.00
Upper middle	20	14.49	4	2.90	3	2.17
Lower middle	30	21.74	7	5.07	2	1.45

Upper lower	26	26.09	20	14.49	3	2.17
ower	7	5.07	3	2.17	0	0.00

The study population belonged to the lower middle (26%) and was found to be in the age group of the youngest old category, there was no such evidence between socioeconomic status and age here. This is because patients in this age group were often admitted to the hospital during the research period and also this study was carried out in a multi-specialty tertiary care facility that is primarily accessible to the upper and middle class. Because the middle-class accounts for a sizable portion of the Indian population and hence the patient will be more from the middle class.



**Fig 6.1.7 Bar diagram showing the distribution of age against socioeconomic status**

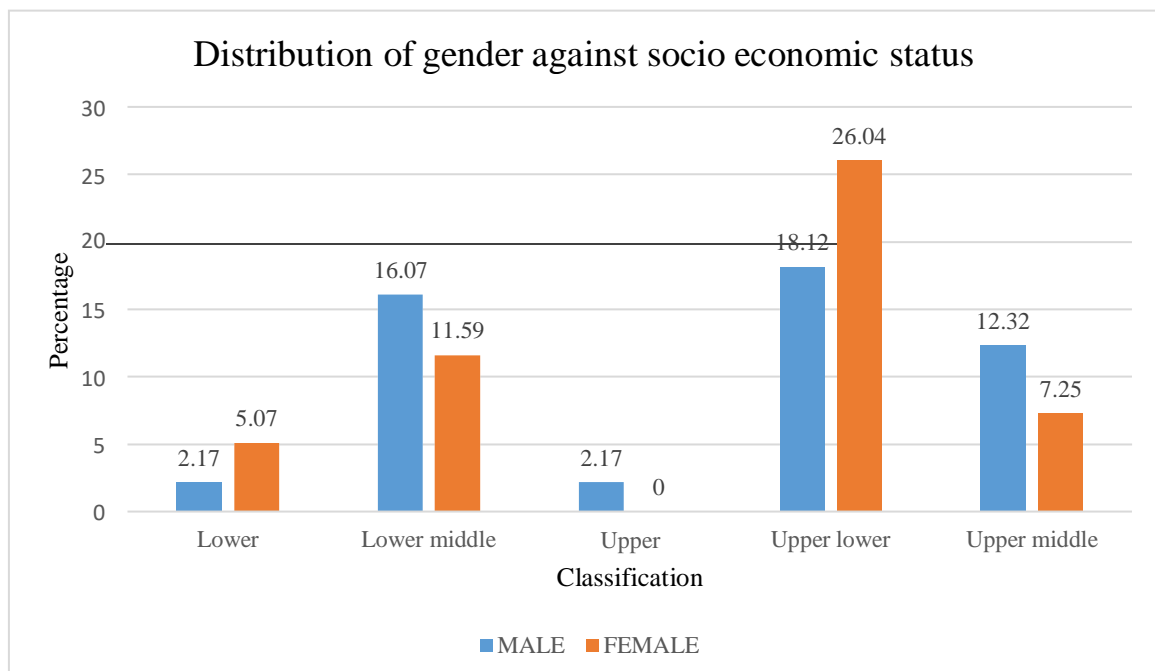
#### **6.1.7 DISTRIBUTION OF SOCIO-ECONOMIC STATUS AGAINST GENDER.**

Among 138 patients, 2.17% (N=3) were males belonging to the Upper Class, 12.32% (N=17) were males and 7.25% (N=10) were females belonging to the Upper-Middle class. 16.67% (N=23) were males and 11.59% (N=16) were females belonging to the Lower Middle class. 18.12% (N=25) were males and 24.64% (N=34) were females belonging to the Upper Lower class. 2.17% (N=3) were males and 5.07% (N=7) were females belonging to the Lower Class. Female patients (24.64%) belonging to the Upper-Lower class were more prone to Polypharmacy than male patients.

**Table 6.1.7 Distribution of socio-economic status against gender.**

SOCIO-ECONOMIC CLASS	GENDER			
	MALE		FEMALE	
	N	%	N	%
Upper	3	2.17	0	0
Upper middle	17	12.32	10	7.25
Lower middle	23	16.67	16	11.59
Upper lower	25	18.12	34	24.64
Lower	3	2.17	7	5.07

There are no relevant research studies on the relationship between socioeconomic status and gender in the emergence of infection. Some data reveals in developing nations like India men are more likely to seek treatment from established health systems, but women are more inclined to self-treat or employ alternative remedies. In this study, the majority of patients were males in the age group of 60-70 years from the upper lower class. This is because of the difference in pathogen exposure status among males and females. The main factor behind the easy spreading of infection among males was owing to their greater exposure to public and occupational environments than females.

**Fig 6.1.7 Bar diagram showing Distribution of socio-economic status against gender.**

### 6.1.8 DISTRIBUTION OF HOSPITAL STAY

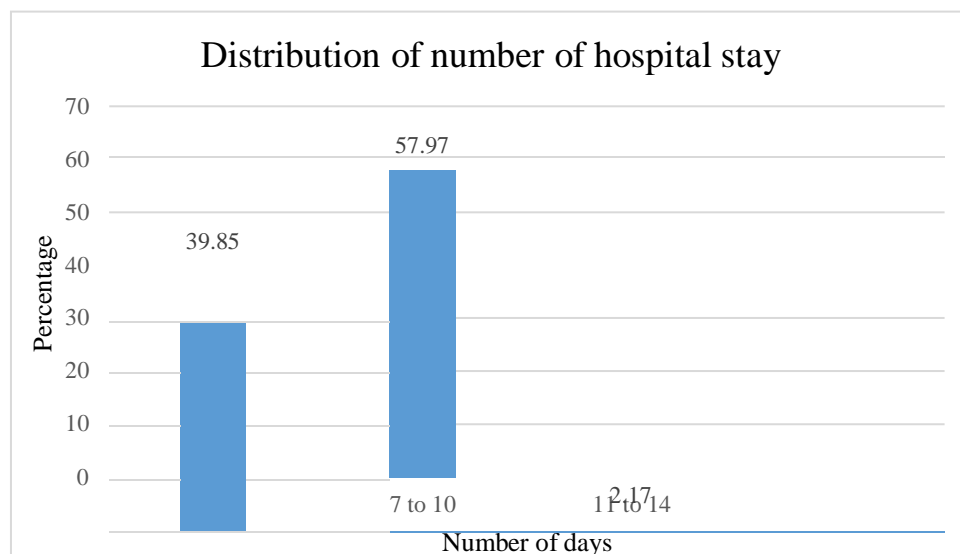
Among 138 patients, 39.85% (N=55), 57.97% (N=80) and 2.17% (N=3) patients were admitted for 2-6 days, 7-10 days, 11-14 days. Here the patient with the higher number of hospital days was in between 7-10 days (57.97%) followed by 2-6 days (39.85%), 11-14 days (2.17%).

**Table 6.1.8 Frequency and percentage distribution of samples based on hospital stay.**

NO: OF HOSPITAL STAYS	FREQUENCY(N)	PERCENTAGE (%)
2-6 days	55	39.85%
7-10 days	80	57.97%
11-14days	3	2.17%

The length of stay (LOS) in hospitals is a widely used and important criterion for evaluating hospital performance. our study shows that the patients with the highest number of hospital stays were between 7-10 days. A similar study was conducted by *Omid khoshravizadeh et al*<sup>[62]</sup> where the mean of hospital LOS was

5.45 ± 6.14 days. Age, employment, marital status, history of the previous admission, patient condition at discharge, method of payment, and type of treatment had an impact on LOS ( $p < 0.05$ ). Other factors, including gender, place of residence, and type of admission, did not affect LOS. Because hospitals consume a perceptible part of resources in a health system, controlled and optimized use of its resource helps to save a lot. Therefore, this study showed many clinical and nonclinical factors affect LOS in evaluating these factors, which may reduce inappropriate hospital stays and decrease costs.



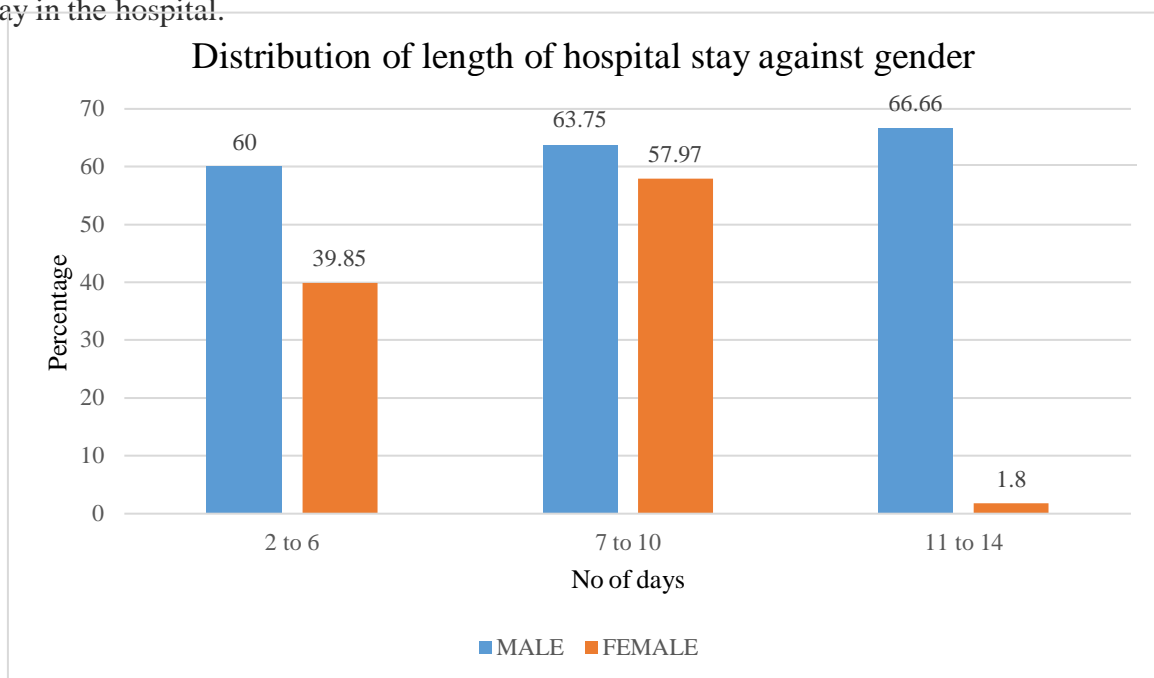
**Fig 6.1.8 Bar diagram showing the distribution of the number of hospital stay**

**6.1.8.1 DISTRIBUTION OF LENGTH OF HOSPITAL STAYS AGAINST GENDER.** Among 138 patients, 60% (N= 33) of males and 40% (N=22) of females had stay for 2-6days,63.75% (N=51) males and 26.25% (N=29) females had stay for 7-10 days, 66.66% (N=2) males and 26.25% (N=29) females had stay for 11-14 days.

**Table 6.1.8.1 Distribution of length of hospital stays against gender.**

LOS	MALE		FEMALE		TOTAL	
	N	%	N	%	N	%
2-6 days	33	60	22	40	55	39.85
7-10 days	51	63.75	29	26.25	80	57.97
11-14 days	2	66.66	1	33.33	3	2.1

In our study it is found to be higher for males than females and is similar to the study conducted by *Moradhvaj et.al*<sup>[58]</sup> we present age-adjusted HCE by gender for individuals aged 15 years and older. The inpatient HCE for men is substantially higher than for women (Rs. 23,666 for men vs Rs. 16,881 for women). The age-adjusted average HCE for men and women by type of illness. Panel 2 of shows that the age-adjusted average HCE is higher for men than women when the duration of hospitalization is the same. Inpatient HCE is higher among men than women, regardless of the type of disease and duration of the stay in the hospital.



**Fig 6.1.8.1 Bar diagram showing Distribution of length of hospital stays against gender.**

## 6.2 WHO INDICATORS

Among 138 patients, total number of drugs prescribed (1135, 12.15%), total number of drugs prescribed by generic name (170,14.97%), total number of drugs prescribed by brand name (965,85.02%), total number of drugs encountered with antibiotics (276, 24.31%), total number of drugs encountered with injections (356,31.36), total number of drugs prescribed from essential drug list (1135, 100%).

**Table 6.2.1 Summary of results from WHO's manual for prescribing indicators assessment**

WHO Indicators	Total drugs	Average or percent per prescription(%)	WHO'S standard derived or ideal
Drugs prescribed	1135	12.15%	1.6-1.8
Drugs prescribed by generic name	170	14.97%	100%
Drugs prescribed by brand name	965	85.02%	
Drug encounter with antibiotics	276	24.31%	20-26.8%
Drug encounter with injections	356	31.36%	13.4-24.1%
Drugs prescribed from Essential Drug List	1135	100%	100%

In our study the total drugs prescribed was 1135 and the average value be 12.15% which is higher than the WHO's standard derived or ideal values similar study was conducted by *Sangharshila et al*<sup>[88]</sup> found that average number of drugs are increasing with increasing age (8.19%). Similar study was conducted by *Igbikstamuno et al*<sup>[100]</sup>, generic prescription was low at 43.7% thus, prescribing the generic drugs can reduce the cost of drugs. Also, similar study from *Sneha ambwani et al*<sup>[61]</sup> found that usage of generic drugs was found only 0.30% of total prescription, reason for reduced use of generic drugs could be not understanding the WHO's prescribing rules, less confident in the quality of generic drugs, prescribers are more familiar with brand names than generic names. Contrary to the study conducted by *Navya teja et al*<sup>[64]</sup> found that drugs prescribed by generic name is 10.5% which is higher than our study findings.

In our study the percentage of brand name prescribed was 85.02% which is similar to study conducted by *Ombeni kisamo et al*<sup>[101]</sup> found that from 1001 prescription 71.6% using brand name for prescribing, more brand name is used for prescribing vitamins and antibiotics. Our study showed that number of antibiotics were 24.31% which was in between the WHO's standard derived or ideal values, similar study by *Sneha ambwani et al*<sup>[61]</sup> found that use of antibiotic was only 5.01% which means the prescription contains less amount of antibiotics compared to the WHO's ideal criteria, it showed that the prescribers were using antibiotics judiciously and rationally, other study similar to our findings conducted by *Navya teja et al*<sup>[64]</sup> found that around 25 % of prescription contain

antibiotics. Creating an awareness about importance of antibiotics stewardship and implementing a rigid hospital antibiotic policy helping compacting the problem of injudicious use of antibiotics leading to antimicrobial resistance. Contrary to the study findings conducted by *Chandelkrar et al*<sup>[66]</sup>, where 31.8 % prescription contained an antibiotic.

It was contrary to the study conducted by *Piyali hazra et al*<sup>[98]</sup> found that on 79 prescription 68 of them had a single injection and 11 of them contained two injections, accounting for 15.76% of total drugs to be injectables. Our study showed that drugs prescribed from essential drug list is 100%, contrary to the study conducted by *Divya et al*<sup>[78]</sup> found that drugs prescribed from WHO's essential drug list was found to be 41.1% were the total number of drugs prescribed was 772 thus essential drugs list satisfy the health care needs of majority of populations which is available at all times in adequate amounts and in appropriate quantity.

### 6.2.2 DISTRIBUTION OF ROUTE OF ADMINISTRATION OF DRUGS

Among 138 patients, per oral (69.14%, N=784), transdermal (0.71%, N=8), sub cutaneous (24.69%, N=280), intravenous (4.50%, N=51), per nasal (0.18%, N=2), ocular (0.88%,N=10). Most of the patients administered through per orally (69.14%), followed by sub cutaneous (24.69%), intravenous (4.50%), ocular (0.88%), transdermal (0.71%).

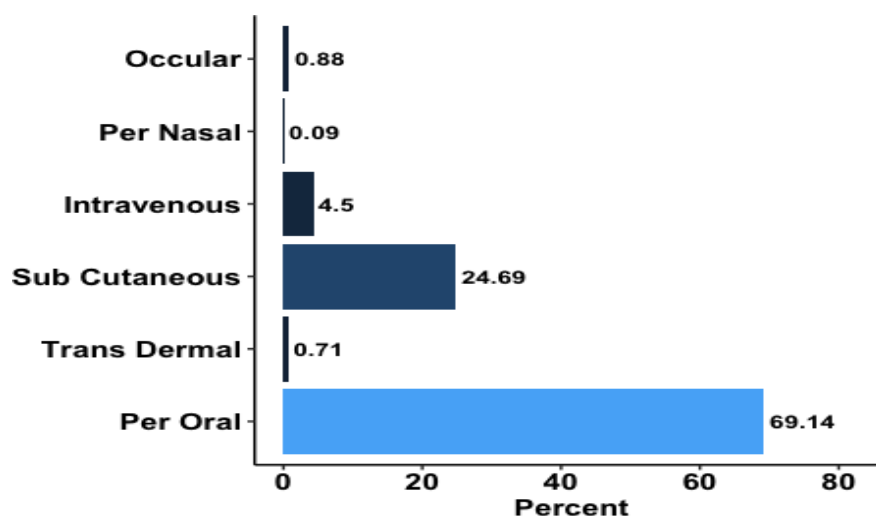
**Table 6.2.2 Distribution of frequency and percentage of Route of administration**

ROA	Frequency(N)	Percentage (%)
Per Oral	784	69.14
Trans Dermal	8	0.71
Sub Cutaneous	280	24.69
Intravenous	51	4.50
Per Nasal	2	0.18
Ocular	10	0.88

In our study 69.14% follows oral route of administration similar to the study conducted by *Hao Zhong et*

*a*<sup>[60]</sup> found that 62.02% follow oral administration route, oral delivery has high patient compliance and ease

of administration. Most convenient and safest mode of drug administration and is economical since it does not involve the patient in extra cost.



**Fig 6.2.2 Bar diagram showing Distribution of the ROA**

### 6.2.3 DISTRIBUTION OF THERAPEUTIC CLASSIFICATION OF DRUGS

Among 138 patients, PPI (10.40%, N=118), Cephalosporin Antibiotics (7.75%, N=88), HMG CoA Reductase Inhibitors (5.81%, N=66), Bronchodilators (5.29%, N=60), Diuretics (5.20%, N=59), Biguanides (4.67%, N=53), NSAIDs (4.58%, N=52), CCBs (3.88%, N=44), Multivitamins (3.35%, N=38), ARBs (3.00%, N=34), Antiplatelet (3.00%, N=34), Haematinics (3.00%, N=34), beta Blockers (2.64%, N=30), Macrolide Antibiotics (2.03%, N=23), Antacids (1.67%, N=19), Osmotic Purgatives (1.67%, N=19). Most common classification of drugs prescribed is PPI (10.40%) followed by Cephalosporin Antibiotics (7.75%), HMG CoA Reductase Inhibitors (5.81%), Bronchodilators (5.29%), Diuretics (5.20%), Biguanides (4.67%), NSAIDs (4.58%), CCBs (3.88%), Multivitamins (3.35%), ARBs (3.00%), Antiplatelet (3.00%), Haematinics (3.00%), beta Blockers (2.64%), Macrolide Antibiotics (2.03%), Antacids (1.67%), Osmotic Purgatives (1.67%).

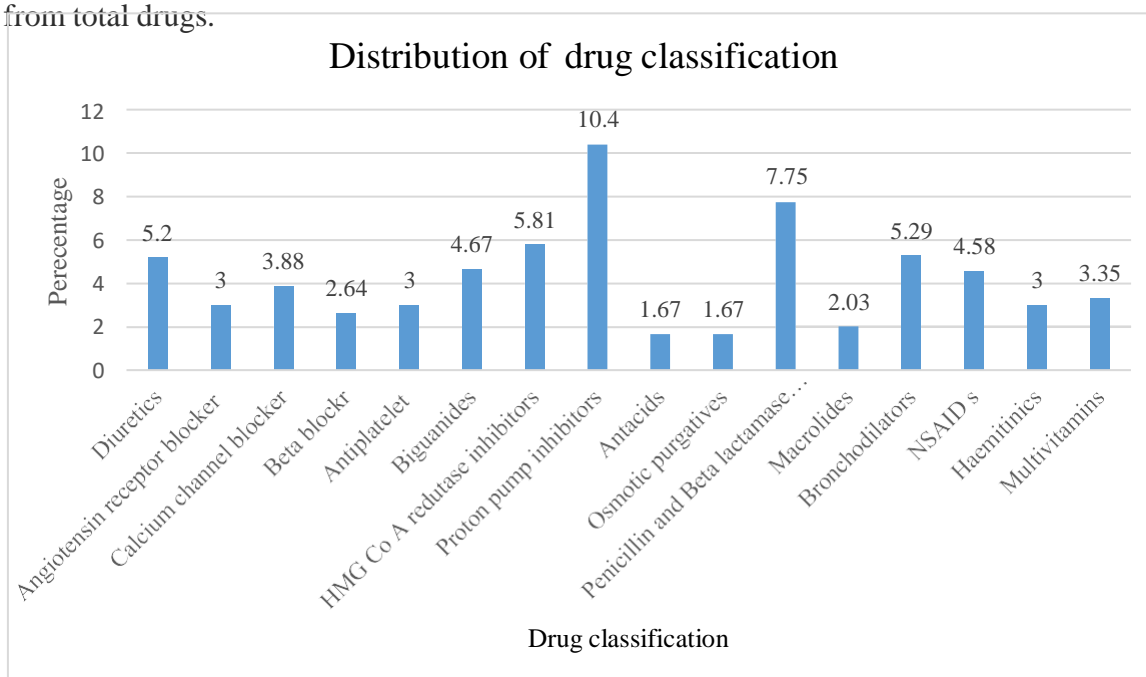
**Table 6.2.3 Distribution of frequency and percentage of Classification of drug.**

CLASSIFICATION	Frequency(N)	Percentage (%)
PPI	118	10.40
Cephalosporin Antibiotics	88	7.75
HMGCoA reductase inhibitors	66	5.81



Bronchodilators	60	5.29
Diuretics	59	5.20
Biguanides	53	4.67
NSAIDs	52	4.58
CCB	44	3.88
Multi Vitamins	38	3.35
ARB	34	3.00
Anti-Platelets	34	3.00
Hematinic	34	3.00
beta- Blockers	30	2.64
Macrolide Antibiotics	23	2.03
Antacids	19	1.67
Osmotic Purgatives	19	1.67

Similar study was conducted by *veronica et al*<sup>[66]</sup> found that 55% of prescribed drugs was under PPI, the majority of them without indication and there was indication for PPI was 29.2 %, primary indication of PPI therapy is the prophylaxis of gastro intestinal bleeding and a contrary study was conducted *Byujjwala et al*<sup>[65]</sup> found that the drugs acting on cardiovascular system was the most common class of drug prescribed (24%) followed by our study findings as PPI drugs are prescribed 10.40% from total drugs.



**Fig 6.2.3 Bar diagram showing Distribution of drug classification**

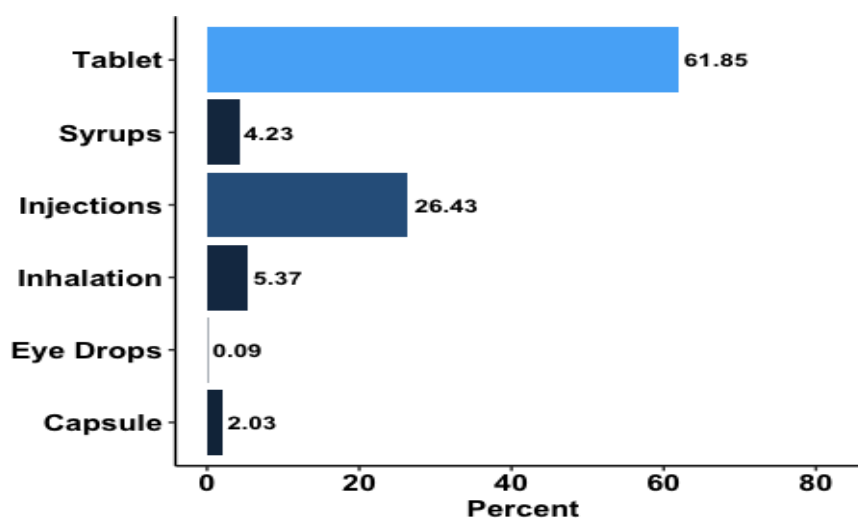
## 6.2.4 DISTRIBUTION OF DOSAGE FORM OF DRUGS

Among 138 prescriptions, Tablets (61.85%, N=702), Capsule (2.03%, N=23), Syrups (4.23%, N=4.23), Inhalation (5.37%, N=61), Eye Drops (0.09%, N=1), Injections (26.43%, N=300). The highest number of dosage form prescribed comes under Tablet (61.85%), followed by Injections (26.43%), Inhalations (5.37%), Syrups (4.23%), Capsule (2.03%), Eye Drops (0.09%).

**Table 6.2.3 Distribution of frequency and percentage of dosage form of drug.**

DOSAGE	FREQUENCY(N)	PERCENTAGE (%)
Tablet	702	61.85
Capsule	23	2.03
Syrups	48	4.23
Inhalation	61	5.37
Eye Drops	1	0.09
Injections	300	26.43

Our study showed that 61.85% of prescribed drugs are in the form of tablets, similar to the study by *Ujjwala et al<sup>[59]</sup>* were in 360 prescription 74% were in the form of tablets, most convenient and safest mode of drug delivery system and is economically feasible to patients since it does not require any cost.



**Fig 6.2.3 Bar diagram showing Distribution of dosage forms**

## 6.3 POLYPHARMACY

### 6.3.1 DISTRIBUTION OF TYPES OF POLYPHARMACY

Out of 138 prescriptions types of polypharmacy was analysed, Adjunctive Polypharmacy (76.09%, N=105), Augmented Polypharmacy (64.49%, N=89), Multiclass Polypharmacy (68.84%, N=95), Same Class

Polypharmacy (44.20%, N=61). Most type of polypharmacy comes under Adjunctive Polypharmacy (76.09%) followed by Multiclass Polypharmacy (68.84%), Augmented Polypharmacy (64.49%), Same Class Polypharmacy (44.20%)

### 6.3.1 Distribution of Frequency and Percentage of Polypharmacy

TYPES	YES		NO	
	N	%	N	%
Adjunctive Polypharmacy	105	76.09	33	23.91
Augmented Polypharmacy	89	64.49	49	35.51
Multiclass Polypharmacy	95	68.84	89	31.16
Same Class Polypharmacy	61	44.20	77	55.80

Our study showed that majority of polypharmacy under the class of Adjunctive Polypharmacy (76.09%) similar to the study conducted by Masnoon *et al*<sup>[88]</sup> were from Total Polypharmacy 72% belonged to Adjunctive Polypharmacy, where the drugs used to reduce the side effects of another drug, here probiotics are given in accordance to treat antibiotic-induced diarrhoea.

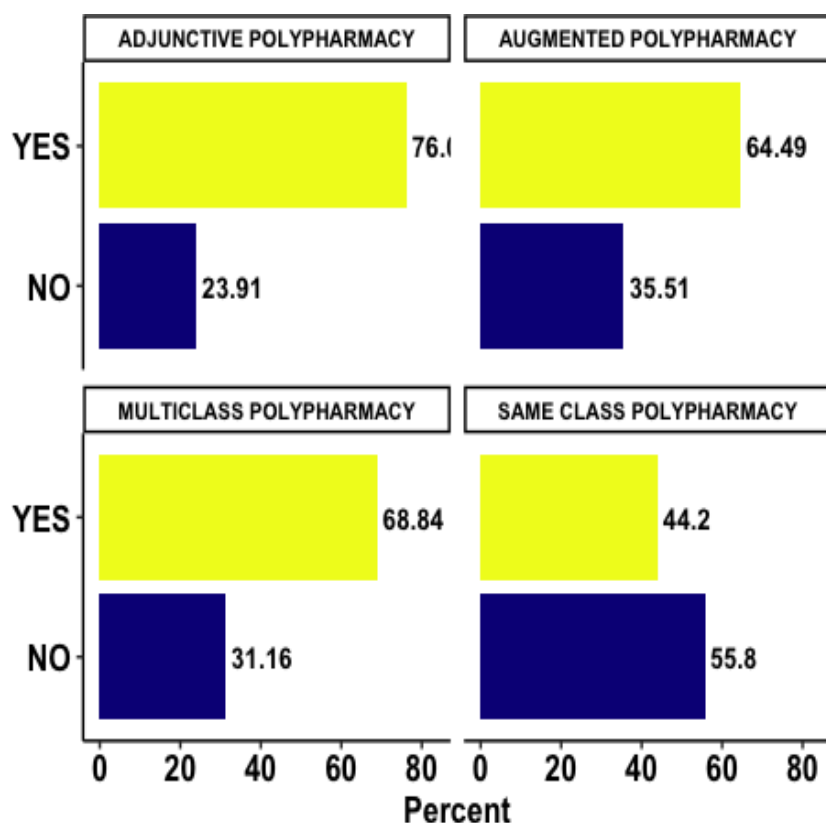


Fig 6.3.1 Bar diagram showing Distribution of type of Polypharmacy

### 6.3.2.1 DISTRIBUTION OF POLYPHARMACY AGAINST GENDER- MALE

Out of 138 prescriptions types of polypharmacy was analysed, Adjunctive Polypharmacy (76.09%, N=105), Augmented Polypharmacy (64.49%, N=89), Multiclass Polypharmacy (68.84%, N=95), Same Class Polypharmacy (44.20%, N=61). The highest number of types of polypharmacy comes under Adjunctive polypharmacy (76.09%) followed by Multiclass Polypharmacy (68.84%), Augmented Polypharmacy (64.49%), Same Class Polypharmacy (44.20%).

#### 6.3.2.1 Distribution of frequency and percentage of polypharmacy against gender- male

TYPES	YES		NO	
	N	%	N	%
Adjunctive Polypharmacy	51	71.83	20	28.17
Augmented Polypharmacy	42	59.15	29	40.85
Multiclass Polypharmacy	50	70.42	21	29.58
Same Class Polypharmacy	34	47.89	37	52.11

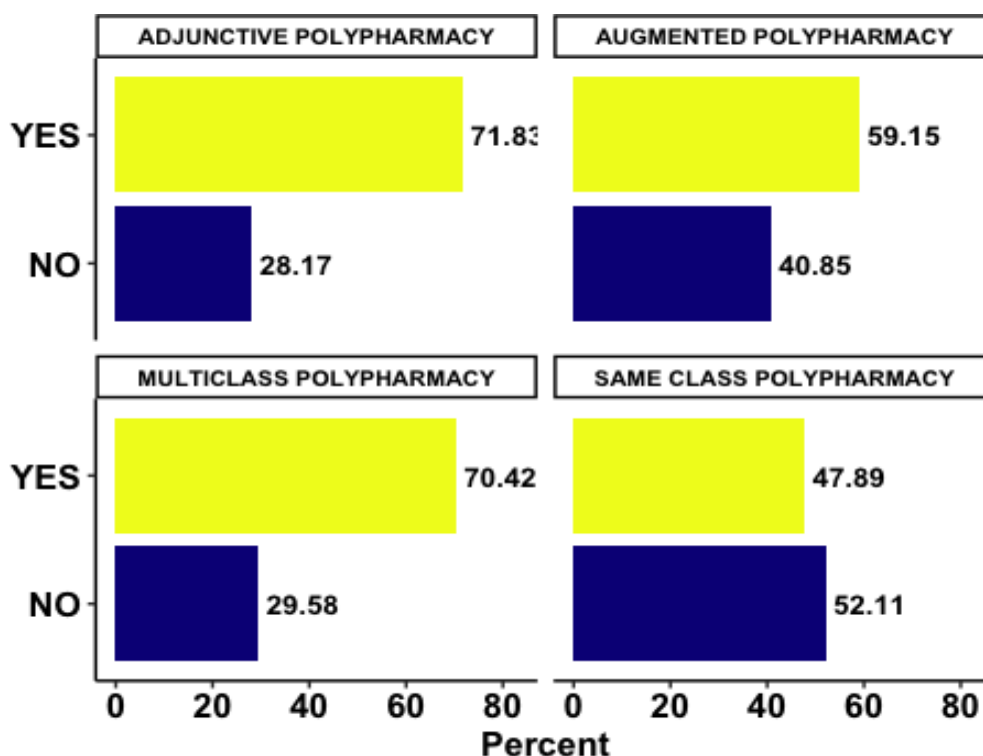


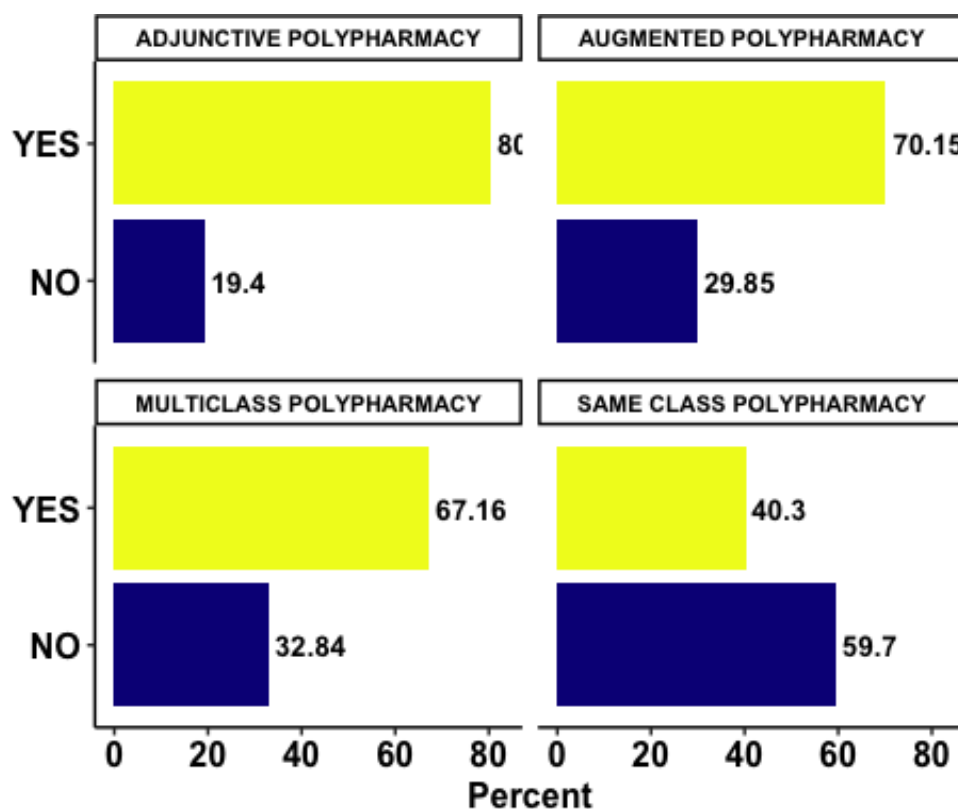
Fig 6.3.2 Bar diagram showing Distribution of type of Polypharmacy(male)

### 6.3.2.2 DISTRIBUTION OF POLYPHARMACY AGAINST GENDER- FEMALE

Out of 138 prescriptions types of polypharmacy was analysed, Adjunctive Polypharmacy (80.60%, N=54), Augmented Polypharmacy (70.15%, N=47), Multiclass Polypharmacy (67.16%, N=45), Same Class Polypharmacy (40.30%, N=27). The highest number of types of polypharmacy females comes under Adjunctive Polypharmacy (80.60%) followed by Augmented Polypharmacy (70.15%), Multiclass Polypharmacy (67.16%) Same Class Polypharmacy (44.20%).

#### 6.3.2.2 Distribution of frequency and percentage of polypharmacy against gender-female

TYPES	YES		NO	
	N	%	N	%
Adjunctive Polypharmacy	54	80.60	13	19.40
Augmented Polypharmacy	47	70.15	20	29.85
Multiclass Polypharmacy	45	67.16	22	32.84
Same Class Polypharmacy	27	40.30	40	59.70



**Fig 6.3.2.2 Bar diagram showing Distribution of type of Polypharmacy(female)**

In our study the distribution of types of polypharmacy in males is higher in the case of adjunctive polypharmacy (71.83%) and in the case of females also the type of polypharmacy, adjunctive is higher (80.60%). Similar to the study conducted by *Mubarak et al*<sup>[91]</sup> males have a prevalence of polypharmacy at

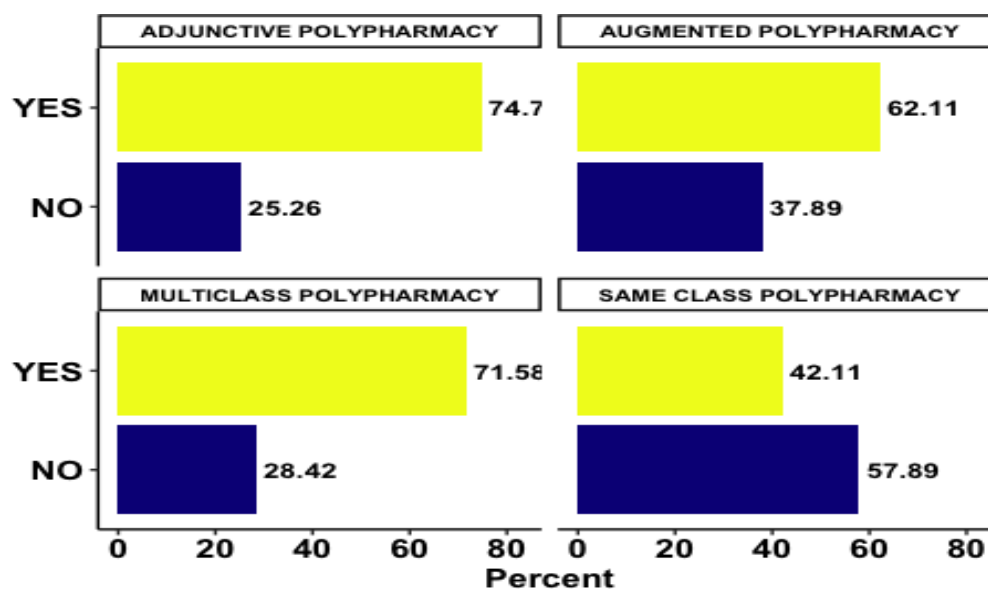
(56 %). In a study similar to our findings was conducted by *Colleen et al*<sup>[67]</sup> prevalence of polypharmacy and hyper polypharmacy increased from 74.9% to 82.1% thus it was higher for females than males.

### 6.3.3 DISTRIBUTION OF POLYPHARMACY AGAINST AGE- YOUNGEST

**OLD** Among 138 prescription was analysed in youngest old (65-75)years, Adjunctive Polypharmacy (74.74%, N=71), Augmented Polypharmacy (62.11%, N=59), Multiclass Polypharmacy (71.58%, N=68), Same Class Polypharmacy (42.11%, N=40). The highest number of polypharmacy in the youngest old comes under Adjunctive Polypharmacy (74.74%), followed by Multiclass Polypharmacy (62.11%), Augmented Polypharmacy (62.11%), Same Class Polypharmacy ( 42.11%).

**TABLE 6.3.3 DISTRIBUTION OF POLYPHARMACY AGAINST AGE- YOUNGEST OLD**

TYPES	YES		NO	
	N	%	N	%
Adjunctive Polypharmacy	71	74.74	24	25.26
Augmented Polypharmacy	59	62.11	36	37.89
Multiclass Polypharmacy	68	71.58	27	28.42
Same Class Polypharmacy	40	42.11	55	57.89



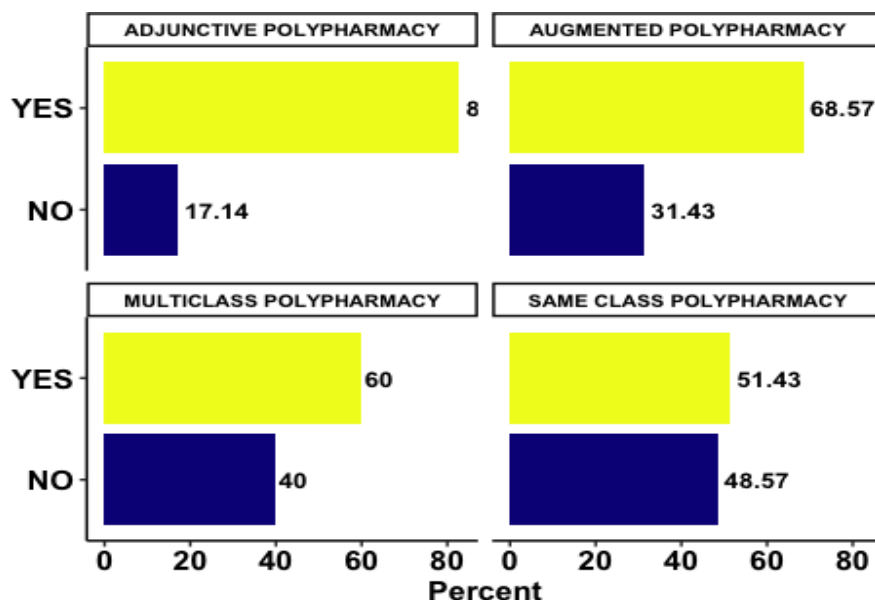
**Fig 6.3.3 Bar diagram showing the distribution of polypharmacy against age- youngest old**

### 6.3.3.2 DISTRIBUTION OF POLYPHARMACY AGAINST AGE- MIDDLE

**OLD** Among 138 prescription was analysed in middle old (75-85) years, Adjunctive Polypharmacy (82.86%, N=29), Augmented Polypharmacy (68.57%, N=24), Multiclass Polypharmacy (60.00%, N=21), Same Class Polypharmacy (51.43%, N=18). Highest number of polypharmacy in the middle old comes under Adjunctive Polypharmacy (82.86%), followed by Augmented Polypharmacy (68.57%), Multiclass Polypharmacy (60%) Same Class Polypharmacy (51.43%).

**TABLE 6.3.3.2 DISTRIBUTION OF POLYPHARMACY AGAINST AGE- MIDDLE OLD**

TYPE	YES		NO	
	N	%	N	%
Adjunctive Polypharmacy	29	82.86	6	17.14
Augmented Polypharmacy	24	68.57	11	31.43
Multiclass Polypharmacy	21	60.00	14	40.00
Same Class Polypharmacy	18	51.43	17	48.57



**Fig 6.3.3.2 Bar diagram showing distribution of type of polypharmacy against age (middle old)**

### 6.3.3.3 DISTRIBUTION OF POLYPHARMACY AGAINST AGE- OLDEST OLD

Among 138 prescription was analysed in oldest old (>85) years, Adjunctive Polypharmacy (62.5%, N=5), Augmented Polypharmacy (75.0%, N=6), Multiclass Polypharmacy (75.0%, N=6), Same Class Polypharmacy (37.5%, N=3). Highest number of polypharmacy in Oldest old comes equally under Augmented Polypharmacy (75.0%) and Multiclass Polypharmacy (75.0%), followed by Adjunctive Polypharmacy (62.5%), Same Class Polypharmacy (37.15%).

**TABLE 6.3.3 DISTRIBUTION OF POLYPHARMACY AGAINST AGE- OLDEST OLD**

TYPE	YES		NO	
	N	%	N	%
Adjunctive Polypharmacy	5	62.5	3	37.5
Augmented Polypharmacy	6	75.0	2	25.0
Multiclass Polypharmacy	6	75.0	6	75.0
Same Class Polypharmacy	3	37.5	5	62.5

It is contrary to the study conducted by *Eric et al*<sup>[75]</sup> where patients with major polypharmacy come under the age of 73-75 years, moderate polypharmacy seen in the age of 68-80 years, polypharmacy can occur due to aging and age related changes it reduces hepatic blood flow and change in drug clearance, changes can also result from chronic diseases or malnutrition other cause is self-medication and lack of communication with the health care team, from our study in case of younger old and middle old the adjunctive polypharmacy, is higher as 74.74% and 82.86% respectively.

## 6.4 DISTRIBUTION OF ECONOMIC ANALYSIS

### 6.4.1 DISTRIBUTION OF DIRECT COST AGAINST SOCIO ECONOMIC STATUS

The mean direct cost of each class of socioeconomic scale of the 138 patients, Upper Class (55644), Upper- Middle (67881), Lower-Middle (56730), Upper-Lower (63643), Lower (59128). According to this Upper- Middle class was having the highest direct cost (67881), followed by Upper-Lower (63643), Lower (59128), Lower-Middle (56730) and Upper Class (55644).

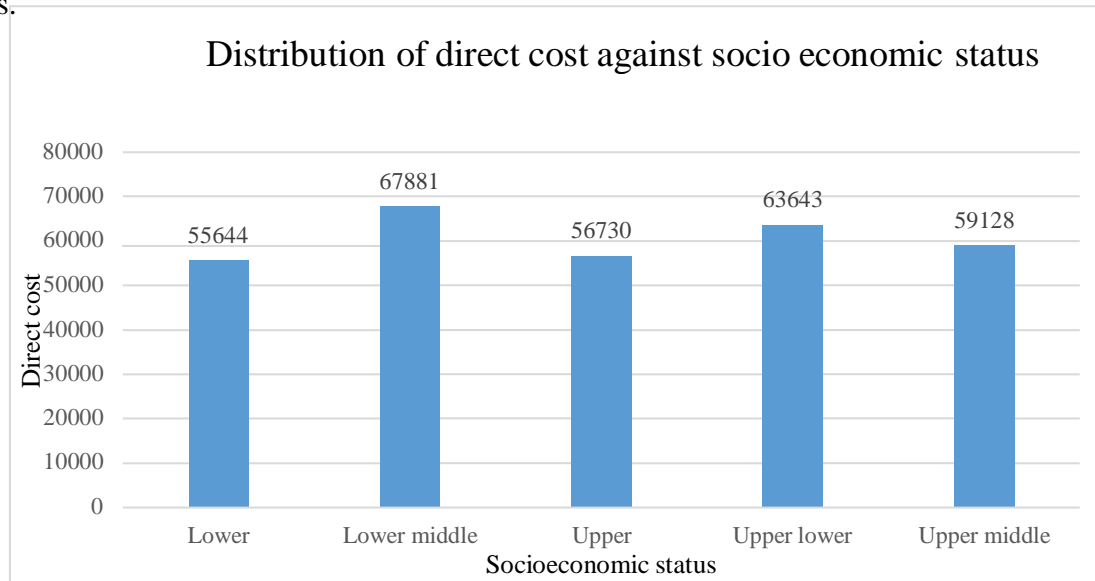
**TABLE 6.4.1 DISTRIBUTION OF DIRECT COST AGAINST SOCIO ECONOMIC STATUS**

SOCIO ECONOMIC SCALE	MEAN(Rs /-)
Upper Class	55644
Upper Middle	67881
Lower Middle	56730
Upper Lower	63643
Lower	59128

In our study results conclude that the mean values between each class of socioeconomic status scale have not much difference between each other thus the direct cost is higher to the patients it includes the doctor fee, cross consultation fee, laboratory charges etc. Thus, the higher mean direct cost is for upper middle followed by upper lower, lower, lower middle. Thus, the study shows the lower class of patients have



economic burden on direct cost in the hospital stay. Similar to the study by *Mariana galente et al*<sup>[93]</sup> found an economic impact on the health care services were described. As expected, the inpatients needed more time to recover and mean length of work sick leave was 30.5 days as compared to outpatients.



#### 6.4.1 Bar diagram showing distribution of direct cost against socio economic status

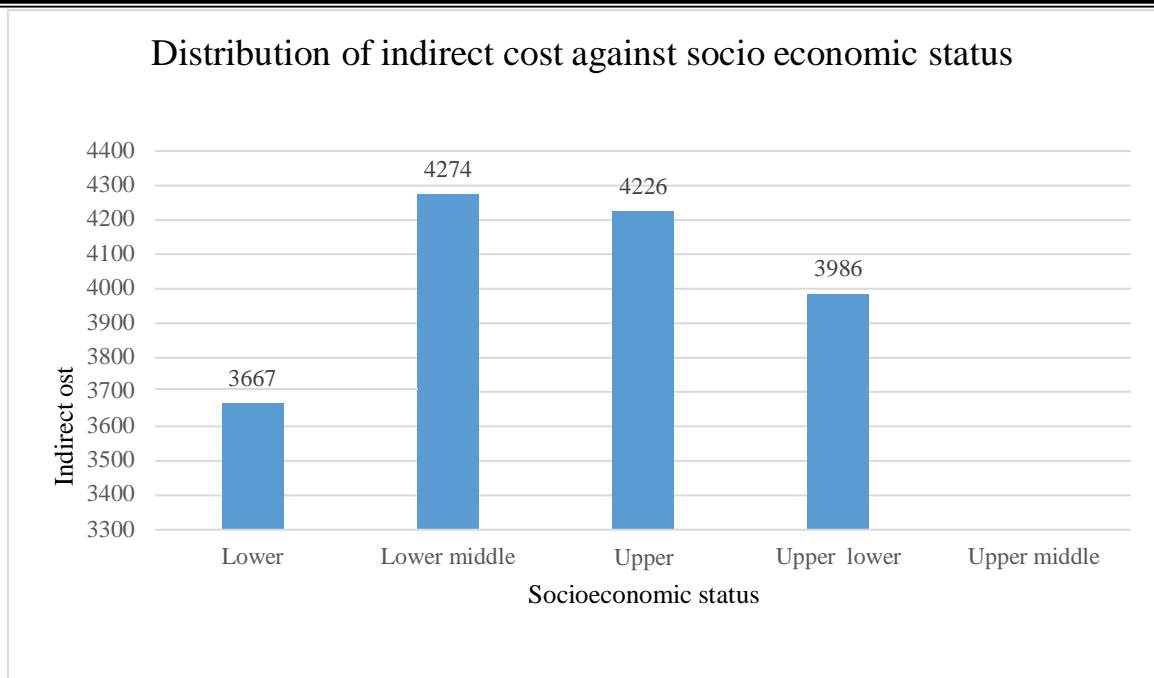
#### 6.4.2 DISTRIBUTION OF INDIRECT COST AGAINST SOCIO ECONOMIC STATUS

The mean indirect cost of each class of socioeconomic scale of the 138 patients, Upper Class (3667), Upper Middle (4274), Lower Middle (4226), Upper Lower (3986), Lower (4334). According to this lower class was having the highest direct cost (4334), followed by Upper Middle (4274), Lower Middle (4226), Upper Lower (3986) and Upper Class (3667).

**TABLE 6.4.2 Distribution of indirect cost against socio economic status**

SOCIO ECONOMIC SCALE	MEAN (Rs /-)
Upper Class	3667
Upper Middle	4274
Lower Middle	4226
Upper Lower	3986
Lower	4334

This means that there was a clear relationship between socio economic scale and indirect cost, here the indirect cost includes the transportation charges, bystander expenditures are higher for the Lower Class thus clear evidence of economic burden to the Lower-Class patients.



**6.4.2 Bar diagram showing distribution of indirect cost against socio economic status**

#### **6.4.3 DISTRIBUTION OF TOTAL COST AGAINST SOCIO ECONOMIC STATUS**

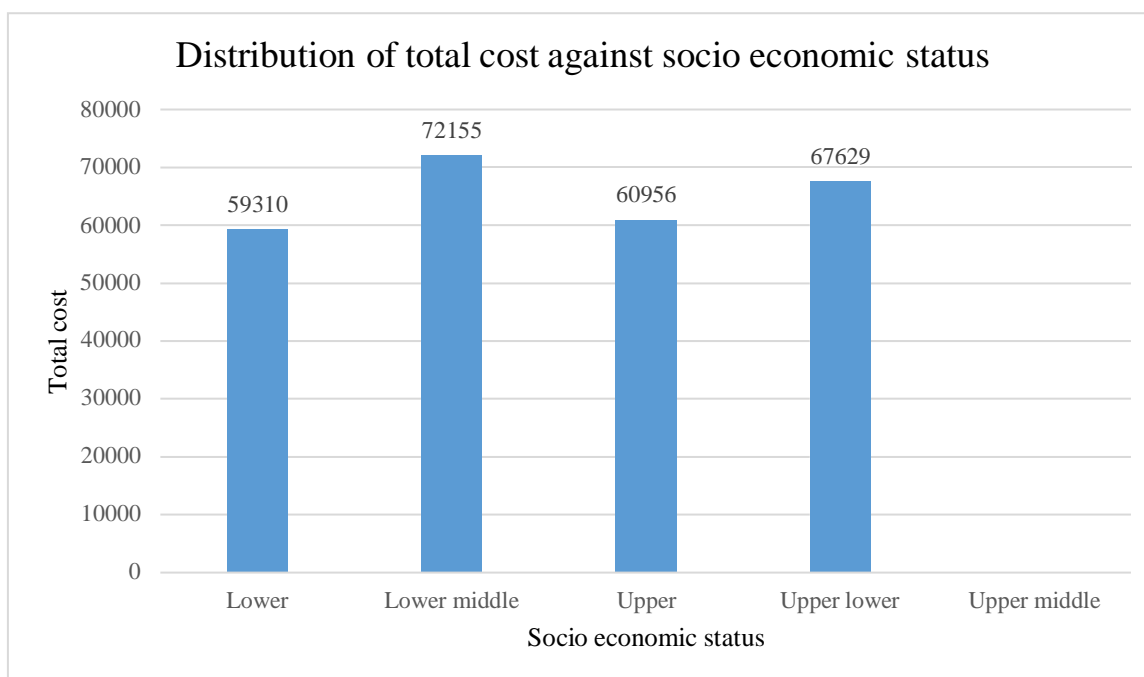
The mean total cost of each class of socioeconomic scale of the 138 patients, Upper Class (59310), Upper Middle (72155), Lower Middle (60956), Upper Lower (67629), Lower (63462). According to this Upper Middle Class was having the highest Direct Cost (72155), followed by Upper Lower (67629), Lower (63462), Lower Middle (60956), and Upper Class (59310).

**TABLE 6.4.3 Distribution of total cost against socioeconomic status**

SOCIO-ECONOMIC SCALE	MEAN (Rs /-)
Upper Class	59310
Upper Middle	72155
Lower Middle	60956
Upper Lower	67629
Lower	63462

This means that when comparing the total cost and the socioeconomic status, Upper-Middle class patients have slightly higher total cost compared to the Lower Middle and Lower Class but there is not much difference in the mean total cost of each class of patients, thus Upper-Lower, Lower-Middle, the Lower Class of patients which are comparatively less economic background so that the total cost of the hospital stay becomes economically burden to the patient who is admitted during the study population in the tertiary

care hospital. The study was conducted in a rural area and the patient seeking medical care was in the Middle class or in Lower Class. Thus, this study concludes there is an economical burden to the Middle- or Lower-Class patients.



**6.4.3 Bar diagram showing the distribution of total cost against socio-economic status**

#### **6.4.4 DISTRIBUTION OF SOCIO ECONOMIC STATUS AGAINST TOTAL MONTHLY INCOME**

Among 138 patients, Upper Lower with income (6,175-18,496) (24.64%, N=34), Upper Lower with income (<6174) (15.22%, N=21), Lower Middle with income (18,497-30830) (14.49%, N=20), Lower Middle with

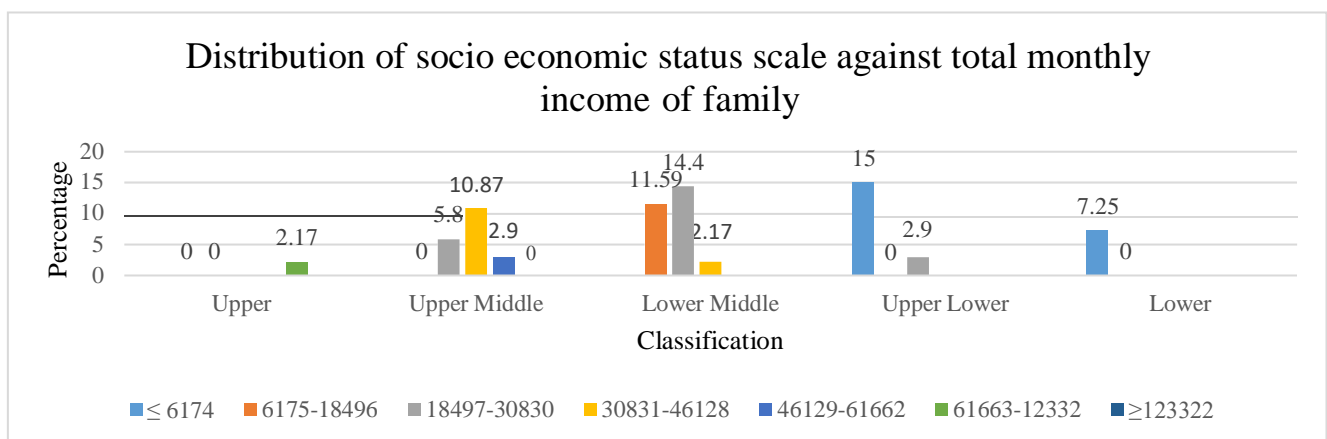
income (6,175-18,496) (11.59%, N=16), Upper Middle with income (30831-46,128) (10.87%, N=15),

Lower with income (<6174) (7.25%, N=10), Upper Middle with income (18,497-30830) (5.80%, N=8), Upper Lower with income (18,497-30830) (2.90%, N=4), Upper Middle with income (46129-61662) (2.90%, N=4), Lower Middle of income (30,831-46128) (2.17%, N=3), Upper Class of income (61663- 123,321) (2.17%, N=3). According to this the highest total cost against socioeconomic status comes under Upper Lower with income (24.64%, N=34), Upper Lower with income (15.22%, N=21), Lower Middle with income (14.49%, N=20), Lower Middle with income (11.59%, N=16), Upper Middle with income (10.87%, N=15), Lower with income (<6174)(7.25%, N=10), Upper Middle with income (5.80%, N=8), Upper Lower with income (2.90%, N=4), Upper Middle with income (2.90%, N=4), Lower Middle of income (2.17%, N=3), Upper Class of income (2.17%, N=3).

**TABLE 6.4.4 Distribution of socio-economic status against total monthly income.**

SOCIO ECONOMIC STATUS SCALE	TOTAL MONTHLY INCOME OF FAMILY	FREQUENCY (N)	PERCENTAGE (%)
4	2	34	24.64
4	1	21	15.22
3	3	20	14.49
3	2	16	11.59
2	4	15	10.87
5	1	10	7.25
2	3	8	5.80
4	3	4	2.90
2	6	4	2.90
3	4	3	2.17
1	10	3	2.17

This means that the total cost against the socioeconomic status is higher to the Upper-Lower with income of Rs (6,175-18,496) because the hospital is located in a rural area setting. Patients with Lower or Middle Class seek more medical attention from the hospital. Since the patients are in the Lower or Middle Class their income also be economically less. From our study these populations can have more economic burden as compared to the higher class of the population, there were no relevant studies similar to this study and can be varied according to the hospital and the study area settings.



**6.4.4 Bar diagram showing distribution of socio-economic status against total monthly income of family**

## LIMITATIONS

- **Small sample size:** The sample size was only 138 which was insufficient to determine the outcome as a true finding.
- **Limited time duration:** The duration of the study was limited to less than 6 months which may cause a yield of non-reliable and non-precise estimates.
- The above-mentioned limitations also affect the socio-economic status which directly affects the study.

## CONCLUSIONS AND RECOMMENDATIONS

Polypharmacy and PIMs are associated as they go hand-in-hand owing to numerous comorbid circumstances in geriatric communities that require polypharmacy, leading to harmful PIMs. On the other side, the motivation of physicians and patients for quick relief of symptoms also led to the consumption of inappropriate drugs and irrational combinations of fixed drugs. The significant health risks in the geriatric population are these variables.

In the care of geriatric patients, healthcare professionals should be educated. The prescribers should be familiar with the understanding of the generic name and EDL to use drugs rationally, thereby reducing the financial strain on society. It is vital to create a national list of PIMs based on race and ethnicity in the nation to prevent adverse drug reactions in the geriatric population. The prescription patterns of prescribers should be periodically assessed to provide feedback, training, and awareness on rational drug use. In the study, potentially inappropriate medications, polypharmacy, irrational fixed drug combination and use of brand names in prescription were some of the anomalies observed that need to be rectified by improving practices.

In the year 2022, a prospective, observational study was done on geriatric patients under the supervision of all departments for a duration of six months. We assessed the demographic details of patients, duration of hospital stays, and socioeconomic status by using a modified Kuppaswamy Socioeconomic scale and resistance of patients. Cost of illness was calculated by interviewing the patients on direct medical and non-medical costs, including the cost of drugs, cost of laboratory tests, cost of transportation, cost of rent, cost of food, loss of wages, etc.

This study is additional evidence that the prevalence of poly-pharmacy is widespread among elderly patients. Evaluating the relationship between poly-pharmacy and other factors such as age, gender, level of education, number of medications, drug-drug interactions, interventions, and co-morbidities

revealed that there is a clear relationship. Therefore, a step-wise approach should be developed in all hospitals to decrease the exposure of elderly patients to poly-pharmacy.

Thus, inclusive educational programs targeting primary care physicians, other healthcare professionals, and elderly patients should be developed. This will ensure safe, effective, and appropriate use of medications in specific populations. Strategies should also be defined to closely monitor the elderly who are more likely to be exposed to poly-pharmacy to increase the awareness of the magnitude of the poly-pharmacy phenomenon,

improve drug therapy and minimize drug intake in elderly patients with a substantial decrease in the cost of drugs.

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**EZHUTHACHAN COLLEGE OF PHARMACEUTICAL SCIENCES  
NEYYATTINKARA, TRIVANDRUM, KERALA**

**A CROSS-SECTIONAL STUDY ON THE PREVALENCE AND IMPACT OF  
POLYPHARMACY IN GERIATRIC POPULATION**

Case No.:

Case Title:

**DATA COLLECTION FORM**

Date: \_\_\_\_\_

**DEMOGRAPHICS**

Name:

DOA:

Age:

DOD:

Gender:

No. of hospital stay:

Department:

Year of study:

1. Reason for admission: \_\_\_\_\_

2. Occupation of head of family:

S.NO.	OCCUPATION
1.	Legislatures, senior officials and managers
2.	Professionals
3.	Technician and associate professionals
4.	Clerks
5.	Skilled workers and shop and market sales workers
6.	Skilled agricultural and fishery workers
7.	Craft and related trade workers
8.	Plant and machine operators and assemblers
9.	Elementary occupation
10	Unemployed



3. Education of head of family:

S.NO.	EDUCATION
1.	Profession or honors
2.	Graduate
3.	Intermediate or diploma
4.	High school certificate
5.	Middles school certificate
6.	Primary school certificate
7.	Illiterate

4. Total monthly income of the family:

S.no.	Updated monthly family income inrupees (2021)
1.	$\geq 1,23,322$
2.	61,663 – 1,23,321
3.	46,129 – 61,662
4.	30,831 – 46,128
5.	18,497 – 30,830
6.	6,175 – 18,496
7.	$\leq 6174$

**PAST MEDICATION HISTORY**

Sl No.	Brand Name	Generic Name	Dose	Frequency	Duration of use
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					

## 8. TREATMENT CHART

[illegible]

CATEGORY OF COST	PARAMETERS	AMOUNT	TOTAL COST
DIRECT COST	CROSS CONSULTATION		
	DIETICIAN		
	DOCTOR FEE		
	NURSING FEE		
	LAB CHARGES		
	RADIOLOGY CHARGES		
	CASUALTY CHARGES		
	MEDICINE CHARGES		
	LESS MEDICINE RETURN CHARGES		
	OP ADMISSION CHARGES		
	ICU/CCU CHARGES		
	PHYSICAL THERAPIST		
INDIRECT COST	TRANSPORTATION COSTS		
	BYSTANDER CHARGES		
	MODIFICATION OF HOME TO PATIENT		
	ROOM RENT		
	MISCELLANEOUS CHARGES		

**MODIFIED KUPPUSWAMY SES SCALE****Table 1:** Occupation of the Head of the family

S. No.	Occupation of the Head	Score
1	Legislators, Senior Officials & Managers	10
2	Professionals	9
3	Technicians and Associate Professionals	8
4	Clerks	7
5	Skilled Workers and Shop & Market Sales Workers	6
6	Skilled Agricultural & Fishery Workers	5
7	Craft & Related Trade Workers	4
8	Plant & Machine Operators and Assemblers	3
9	Elementary Occupation	2
10	Unemployed	1

**Table 2:** Education of the Head of the family

S. No.	Education of the Head	Score
1	Profession or Honours	7
2	Graduate	6
3	Intermediate or diploma	5
4	High school certificate	4
5	Middle school certificate	3
6	Primary school certificate	2
7	Illiterate	1

**Table 3:** Total monthly income of the family

S. No.	Updated Monthly Family Income in Rupees (2012)	Updated Monthly Family Income in Rupees (2018)	Updated Monthly Family Income in Rupees (2020)	Updated Monthly Family Income in Rupees (2021)	Score
1	≥ 30,375	≥ 126,360	≥ 199,862	≥ 123,322	12
2	15,188–30,374	63,182–126,359	99,931–199,861	61,663–123,321	10
3	11,362–15,187	47,266–63,181	74,755–99,930	46,129–61,662	6
4	7594–11,361	31,591–47,265	49,962–74,755	30,831–46,128	4
5	4556–7593	18,953–31,590	29,973–49,961	18,497–30,830	3
6	1521–4555	6327–18,952	10,002–29,972	6,175–18,496	2
7	≤ 1520	≤ 6326	≤ 10,001	≤ 6174	1

**Table 4:** Kuppuswamy socio-economic status scale 2021

S. No.	Score	Socioeconomic Class
1	26–29	Upper (I)
2	16–25	Upper Middle (II)
3	11–15	Lower Middle (III)
4	5–10	Upper Lower (IV)
5	< 5	Lower (V)

## TYPE OF POLYPHARMACY

Same class polypharmacy	
Multi class polypharmacy	
Adjunctive polypharmacy	
Augmentation polypharmacy	

## **INFORMED CONSENT FORM**

Full title of the Project:

Name of the principal investigator:

**Please initial**

I confirm that I have read / had read to me the leaflet, about this research project and I understand the content.

**YES/NO**

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason

**YES/NO**

I agree to part in the interview.

**YES/NO**

I agree for the data collected from me to be used in future research.

**YES/NO**

I agree to take part in the above research project.

**YES/NO**

**Name of the Patient**

**Participant**

**Signature**

**പദ്ധതിയുടെമുഴുവൻപരമാർദ്ദിപ്രധാനഅപനഷ്ടകന്ടംപെർ: ദയവായിആരംഭിക്കുക**

ഈ ഗവേഷണ പ്ാജക്ടിനകകുെെിച്ഛുള്ല ലഘു പലവെൊൻവായിച്ഛിടൂണ്ട്/  
വായിച്ഛിടൂടണ് ാൻസ്ഥിരീകരീകകുകയുെെളള്ല ക്കെമനസ്സിലാകകുകയു  
ടന്നെെ ുടയുെെ.

അടത / അല്പ

എന്നുടൻ പെൺകുട്ടി താൻ സ്നേഹിക്കുന്നവരോട് താഴെ പറയുന്നവയെക്കുറിച്ച് സംസാരിക്കുക.

**ലുംപിൻവലിക്കാൻ എത്രയും പെട്ടെന്ന് തീരുമാനമെടുക്കണം.**

അടത / അല

അഭിമുഖത്തിൽ പടർക്കുകാൻ ഞാൻ സമ്മതിക്കുന്നില്ല.

അടയ്ക്ക / അടയ്ക്ക

എന്നിരുന്നിപ്പോഴും ഹൈക്കോർട്ടിന്റെ വിധിപ്രകാരമുള്ള പരാതികൾ പരിശോധിക്കുന്നതിനായി സർക്കാർ ഹൈക്കോർട്ടിന്റെ വിധിപ്രകാരമുള്ള പരാതികൾ പരിശോധിക്കുന്നതിനായി സർക്കാർ

International Research Journal  
 നിർപേക്ഷാപരമായ അന്വേഷണത്തിൽ ഉപയോഗി  
 ത്തിക്കുന്നു.  
 IJNRD  
 Research Through Innovation

അടത/അല്ല

മുകുളിലുള്ളഗവൺമെന്റിൽപടയ്ക്കുകാൻതാൻസമ്മതിക്കുന്നു.

അടത/ അല്ല

