**ABSTRACT**

Polypharmacy is arguably one of the most pressing prescribing issues. There is no formally accepted definition, but it is usually considered as concurrent prescribing of at least four or five drugs. Multiple diseases and multimorbidity inevitably lead to the use of multiple drugs, a condition known as polypharmacy. Polypharmacy, a preventable and significant contributor to morbidity and mortality in geriatrics of cardiovascular disease. Aging seldom comes alone, often being accompanied by chronic diseases, co-morbidity, disability and frailty. Older people are particularly prone to adverse consequences due to age related physiological changes altering the pharmacokinetic and pharmacodynamics characteristics of many medicines. Over the last 20–30 years, problems related to aging, multimorbidity, and polypharmacy have become a prominent issue in global healthcare. Therapy in Intensive Care Unit (ICU) often involves polypharmacy and patients require close therapy monitoring. Polypharmacy also has the potential to influence many aspects of safe prescribing, including adverse drug reactions, risk of medication interactions, and adherence. Clinical pharmacists need to challenge the current culture of ‘ratcheting up’ numbers of medications, and to increase awareness of the consequences of polypharmacy. This can be addressed, in part, through continued medical education, and also through clinical guidelines, particularly for common conditions affecting older patients. Proactively addressing the problem has significant potential to maximise quality of life for patients, help patients to manage their own medicines, reduce adverse effects, and encourage more rational and efficacious drug use. When individualization of therapy is warranted, the role of pharmacist can prove to be the best in achieving the therapeutic goals and improve the treatment outcomes of the patients. The main objectives of the study are to assess the prevalence of polypharmacy in cardiovascular disease patient’s ≥ 65 years and to assess the various causes for polypharmacy and to reduce and manage polypharmacy. This Cross Sectional study was carried out in the Department of General Medicine, MIMS Teaching Hospital, Mandya, Karnataka, using a well-designed patient data collection form. Among 114 cardiovascular disease patients analysed 65 patients were males (57.01%) and 49 (42.99%) were females. Among all admitted patients in ICCU, RICU, MICU and medical wards (male and female) for cardiac problems, patients were suffering mostly from co-morbid conditions and commonly found co-morbid condition was hypertension and diabetes mellitus, which supports the study that polypharmacy is extremely high in Hypertensive and Diabetic patients are more prone to high risk of complications (Drug-Drug Interactions and Adverse drug reactions). Polypharmacy was identified in 86 patients (75.43%) which include 51 (59.30%) males and 35 (40.70%) females. The study highlights the emergency department as a place where potential drug interactions can be identified in high-risk elderly patients. The presence of a Clinical Pharmacist would be of potential benefit to the process of identification of Polypharmacy and drug interactions. Furthermore, rational prescribing for the elderly should essentially involve listing potentially inappropriate medications, where the risks of administration may outweigh the benefits of administration. Polypharmacy places geriatric patients at risk of adverse events, functional decline, and geriatric syndromes. The strategies such as use of a risk stratification tool and application of palliative care principles represent initial steps forward to reduce polypharmacy.
INTRODUCTION
Cardiovascular disorders (CVDs) are the group of disorders that involves the heart and blood vessels. Cardiovascular diseases are the leading cause of death globally. Deaths from CVD are more common and largely the product of interactions among modifiable risk factors that are increasing in much of the developing world while rates have declined in most of the developed countries. The increase in CVDs could be attributable to (i) increase in the population size due to natural growth, (ii) ageing of the population which makes people more vulnerable to chronic diseases at older ages, and (iii) increased vulnerability due to lifestyle changes\(^1\). Polypharmacy defined as the use of 5 or more medications. As per the WHO, Polypharmacy refers to use of multiple medications by a patient or more drugs are prescribed than clinically warranted or even when all prescribed medications are clinically indicated but are too many to take (pill burden). This has the potential to cause ADRs due to drug-drug interactions\(^2\). A second and perhaps more important definition is the administration of more medications than are clinically indicated. Drugs are the most common medical interventions for betterment of patients but it had recognised long ago that they are fatal too. The saying rightly goes about the drugs that “Drugs are Double Edged Weapons”\(^3\). The word “poly” is derived from the Greek word meaning more than one and that “pharmacy” referring to the Greek word for drug “pharmacon”\(^4,5\).

Polypharmacy is associated with age, morbidity, and poor self-rated health\(^6\). Also, older people are particularly prone to adverse consequences due to age related physiological changes altering the pharmacokinetic and pharmacodynamics characteristics of many medicines\(^7,8\). Polypharmacy is a common occurrence in elderly patients due to a variety of reasons like increasing comorbidity, availability of non-prescription drugs, hoarding of old medications, inadequate patient knowledge about medications and medical conditions, taking at least one drug for every diagnosis and tendency towards self-treatment/self-medication\(^9\).

With increasing use of medications, the rate of noncompliance and the risks of adverse drug reactions, drug interactions, and drug induced hospitalizations rise. The use of pharmaceutical care principles provides a systematic approach to ensuring good patient education. These include assessment, development of a care plan, establishment of therapeutic goals and follow-up. The assessment process includes an understanding of the patient, disease state, and drug therapy\(^10\). Drug interaction represents a major problem in day-to-day practice\(^11,12\). Drug interaction is defined as modification of the effect of a drug when it is administered with another drug and this effect may increase or decrease the action of either substance or drug. Incidence of DIs is estimated to vary from 6%-30% in hospital admission and they continue to pose a significant risk to the patient’s health outcomes and a considerable economic burden on the healthcare system\(^13\).

POPULATION AGING, CHRONIC DISEASES AND MULTIMORBIDITY:
The process of aging involves a continuum of changes in biological, functional, psychological, and social parameters that vary, depending on genetic factors, age-related vulnerability, and differences in organ function and reserves (Table No.1). Aging seldom comes alone: it is often accompanied by chronic (multiple) diseases, comorbidity, disability and frailty. It is unusual for elderly patients to have only one disease affecting only one organ or apparatus. Although multimorbidity often simply involves the co-occurrence of two or more diseases, the distribution, combination, and development of different diseases (clustering) need to be better understood, as well as the mechanisms leading to the co-occurrence of diseases and the natural history of multimorbidity\(^14\).

<table>
<thead>
<tr>
<th>Organ System and Effects of Aging</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Body composition</td>
</tr>
<tr>
<td>2) Cardiac and peripheral vascular system</td>
</tr>
<tr>
<td>3) Central Nervous system</td>
</tr>
<tr>
<td>4) Gastrointestinal</td>
</tr>
<tr>
<td>5) Renal</td>
</tr>
<tr>
<td>6) Respiratory</td>
</tr>
</tbody>
</table>

Table No.1 Main age-related changes in organ systems.

1) Body composition
   - Progressive reduction in total body water and lean body mass
   - Increase in body fat
2) Cardiac and peripheral vascular system
   - Heart changes (stiffening, reduced muscle strength)
   - Reduction in the intrinsic heart rate
   - Atherosclerosis and loss of elasticity of vessel walls
3) Central Nervous system
   - Increased sensitivity
   - Decreased blood flow
   - Decline in receptors and pathways (fewer brain cells and connections)
4) Gastrointestinal
   - Decreased secretion of hydrochloric acid and pepsin
   - Dysfunction in GI motility
   - Decreased GI blood flow
   - Reduction in liver volume and blood flow
5) Renal
   - Reduction of renal mass and blood flow
   - Decline in GFR
6) Respiratory
   - Vital capacity and FEV may decline with age
   - Increased rigidity of chest wall
   - Reduced thorax muscle strength and endurance

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As age advances the drugs remain in the body for long periods because of delayed absorption and get concentrated in discrete parts of the body due to reduced cardiac output and poor circulation, decreased metabolism by shrunken liver and decreased renal function leading to decreased excretion of drugs. All these features lead to increase in the incidence of drug-drug interactions and adverse drug reactions. Comorbidity or the simultaneous presence of two or more chronic diseases is common in the elderly and is an important reason why treatment must be tailored to the needs of individual patients. The rate of comorbidity in the elderly population has increased steadily since the early 20th century. As people age, the incidence and impact of comorbidity increase, resulting in a decline in well-being and functional abilities. Prescribing multiple medications poses a challenge to healthcare providers. Often, older patients visit multiple physicians for treatment of various conditions. Coordinating medications among multiple physicians in most current healthcare systems is difficult, but without coordination, elderly patients are at increased risk for adverse drug reactions (ADRs). An ADR can result in mild to serious injury to the patient. Patients taking 5 or fewer drugs have a 4% chance of an ADR. With 6 to 10 medications, the risk increases to 10%, and at 11 to 15 medications, the risk of an ADR skyrockets to 28%. These numbers indicate a need to take extra caution when determining the best drug therapy for older patients [15].

Causes for polypharmacy:
Several factors contribute to polypharmacy as shown in Table No.2. In addition, the attitudes of health professionals toward older adults can contribute [16].

Table No.2 Factors Contributing to Polypharmacy.

<table>
<thead>
<tr>
<th>FACTORS THAT CONTRIBUTE TO POLYPHARMACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Multiple disease states</td>
</tr>
<tr>
<td>• Time constraints on health professionals</td>
</tr>
<tr>
<td>• Multiple health care providers</td>
</tr>
<tr>
<td>• Use of non-prescription medications</td>
</tr>
<tr>
<td>• Patient-driven prescribing</td>
</tr>
</tbody>
</table>

Elderly patients have many comorbidities requiring several medications for different problems. Some of the patients are used to take OTC medications and herbal preparations without a clear knowledge of their efficacy and adverse reaction. When side effects occur for some drugs they are misinterpreted as symptoms of a disease and additional drugs are prescribed [17]. A “one drug fits all” approach does not work for elderly patients because they are exposed to unique health variables that are rare in younger patients. When these factors interact in an older patient, individualized drug therapy is required, and restricted drug access could lead to ineffective or negative health outcomes. An older body reacts to pharmaceuticals quite differently than a youthful one due to the physiological changes that accompany aging; metabolism rates change, organ function declines, and sensitivity to some drugs can be altered. Finally, compared with younger patients, there is generally a wider variation in pharmacological action of a drug across individuals. Taken together, these three factors create the need for flexibility in prescribing for the elderly [6].

CONSEQUENCES OF POLYPHARMACY:
Unfortunately, there are many negative consequences associated with polypharmacy. Specifically, the burden of taking multiple medications has been associated with-
• Greater health care costs.
• An increased risk of adverse drug events (ADEs) and drug-interactions.
• Medication non-adherence.
• Reduced functional capacity and multiple geriatric syndromes.

STRATEGIES FOR REDUCING POLYPHARMACY:
Clinical Pharmacists can take many practical and relatively easy steps to help reduce polypharmacy and promote medication adherence. Providing education and medication reduction suggestions to prescribers can reduce the overall number of medications and inappropriate medications. Stopping medications is an effective and safe approach to reducing polypharmacy. Interventions such as computerized decision-support systems and pharmacist involvement in multidisciplinary teams (e.g., geriatric medicine services) can also positively affect prescribing [18].

Risk Identification: High-Risk Patients and Situations:
One essential strategy is to identify, stratify, and target individual patients at higher risk of polypharmacy and ADE. These patient characteristics can be classified into three groups: 1) demographic (increasing age, white race, female gender, higher levels of education), 2) health status (general poor health, cardiovascular disease, hypertension, asthma, diabetes), and 3) access to health care (increased number of health care visits, multiple providers, type of insurance) [19].
Risk Identification: high-risk prescribing practices:

Recognition of inappropriate prescription medications is acknowledged to be an important indicator of quality of care tied to clinical outcomes, and is used as a benchmark in older patients. In practice, researchers and clinicians use several measures to identify potentially inappropriate medications (PIMs). The oldest and most well-known of these is the Beers criteria. The criteria consist of a list of medications to potentially avoid or replace in patients ≥65 years of age. It is simple and can be applied to large populations but has several limitations including: 1) The inclusion of obsolete drugs, 2) A need for periodic updating, 3) some controversial contraindications, 4) Omission of drug-drug interactions or drug duplications, and 5) Overlooking medication omission errors. The Screening Tool of Older Persons Potentially Inappropriate Prescriptions and Screening Tool to Alert Doctors to the Right Treatment (STOPP/START) criteria were developed and validated to address the limitations of the Beers criteria. STOPP/START criteria are organized by system, list drug-drug and drug disease interactions to avoid (e.g. thiazide diuretic with history of gout), and address therapeutic duplication and omission errors. In contrast, the Medication Appropriateness Index (MAI) is considered an implicit tool because it incorporates clinical judgment. The tool consists of 10 questions that are to be applied to each medication, for example: “Is there an indication for the drug? Is it effective for the condition? Is there unnecessary duplication with other drugs?” . The MAI focuses on the patient-medication interaction rather than solely the medication and is able to detect change over time. Lund et al. found that a modified MAI scoring approach (allowing clinicians to decide which MAI items were appropriate) significantly predicted ADE risk, while Beers criteria and the original MAI scoring approach did not. The ideal measure would be simple, easy to calculate, patient-centred, and validated in both inpatient and outpatient settings. While none of the existing measures are perfect, the explicit tools are easier to implement and can even be incorporated into an electronic medical record (EMR). Considering the Beers criteria was designed as a research tool, the STOPP/START criteria may be more practical at flagging high-risk prescribing in clinical practice. The MAI, although more time-consuming, may have promise as a predictive tool for ADE when used by well-trained clinicians and clinical pharmacists.

Polypharmacy can be prevented by avoiding prescriptions for minor nonspecific or self-limiting complaints. In prescribing to elderly patients the broad functional outcomes are usually the major therapeutic goal rather than the specific disease based outcomes. There are certain steps to be followed while prescribing in elderly patients:

- To determine the efficacy in the elderly.
- To determine the likely hood of adverse drug events in the older subjects.
- To discuss harm benefit analysis with the patient and then decide the dosage regimen considering the age related changes in the disposition of and response to medications.
- Monitoring the patient very carefully is essential in view of the paucity of clinical trial data in frail older patients and the marked increase in prevalence of adverse drug reactions.

There are tools like Armor - A tool to evaluate polypharmacy in elderly patients. ARMOR is a stepwise approach for assessment of a geriatric patient who is receiving nine or more medications; seen for initial assessment; seen for falls / behaviours; or admitted for rehabilitation. The clinician first observes heart rate, blood pressure (postural), and oxygen saturation rate at rest and with activity. A physician assessment and physical examination is followed by the following steps:

A = Assess the individual for total number of medications and for certain group of medications that have potential for adverse outcome e.g. Beta blockers, Antidepressants, Antipsychotics, pain medications, vitamins and supplements
R = Review for possible Drug-drug interactions, drug disease interactions.
M = Minimize nonessential medication; eliminate medications that clearly lack evidence for their usage. Eliminate medications whose risks outweigh benefits and that have high potential for negative impact on primary functions.
O = Optimize by addressing duplication, redundancy, adjust drugs according to the hepatic & renal functional status, adjust oral hypoglycaemics to blood sugar target HbA1C
R = Reassess heart rate, blood pressure (postural), oxygen saturation at rest and activity.

ROLE OF CLINICAL PHARMACIST:

Role of clinical pharmacist in Drug therapy Management (DTM) can prove to be the best to achieve therapeutic goals in patients and improves treatment outcomes by effective drug use and patient safety. The complexity and intensity of care required by ICU patients is also associated with greater risks. ICU clinicians are faced with making many important drug dosing decisions each day, even when the correct medication is chosen although, few drug related problems (DRPs) are not preventable as they are unpredictable because of their idiosyncratic nature. Complex pharmacotherapy, simultaneous use of drugs in critically ill patients in ICU often require close monitoring as their safety is of paramount importance. DTM help patients get the most benefit from their medications by monitoring their treatment. Desired outcomes of DTM are appropriate drug use; enhanced patient understanding of appropriate drug use, increased patient adherence, reduced risk of adverse effects and adverse events (AEs) associated with drugs and reduced need for other costly medical services.
Incorporating clinical pharmacist is essential to reduce polypharmacy and occurs in several settings. First, a pharmacist located in the clinic is uniquely situated to educate both patients and providers and has been shown in randomized trials to decrease both the number of total prescribed medications and PIMs. A recent prospective study demonstrated improved clinical outcomes when a clinic pharmacist reviewed each medication regimen, counselled the patient, and provided a report to the health care provider; at 6 months not only did the number of ADE decrease from 2 to 0, but patient adherence also improved significantly. Second, pharmacists in the community and at the level of managed care are able to centralize information from multiple providers. Clinical pharmacists can thus identify PIMs and high-risk drug combinations and then alert both patients and providers. Managed care interventions targeting both patients and physicians with mailed recommendations find that between 15% and 45% of physicians report subsequent change to the medication regimen. These changes are borne out in outcomes data such as decreased polypharmacy events and lower prescription costs each month per member.

**STEPS FOR MANAGING POLYPHARMACY:**

**Prevention**—
Avoid prescribing for minor, non-specific or self-limiting complaints. Only prescribe when there is good evidence of likely efficacy as well as a strong need for the medication.

**Regular medication review**—
An accurate drug history is essential for patients on multiple medicines. This is best achieved when the medication review is done in the patient’s home. Alternatively ask the patient to bring in all their medicines (prescribed and non-prescribed). A review includes assessing appropriateness and on-going need for therapy, adverse effects and interactions, the dosage regime and formulations, and also compliance.

**Non-pharmacological approaches**—
Use lifestyle measures whenever possible either as an adjunct or instead of medications.

**Simplify**—
Reduce the regimen to essential drugs. Consider fewest possible dosage intervals and dose reduction where appropriate. Limit use of optional, trivial and placebo medications.

**OBJECTIVES:**

**PRIMARY:**
To assess the prevalence of polypharmacy in cardiovascular disease patient’s ≥ 65 years.

**SECONDARY:**
- To assess the various causes for polypharmacy.
- To find out measures to reduce and manage polypharmacy.

**MATERIALS AND METHODOLOGY:**
This is a Hospital based Cross Sectional study carried out in various units such as ICCU, RICU, MICU, Medical wards (Male and Female) of the department of general medicine, Mandya Institute of Medical Sciences Teaching hospital, Mandya, Karnataka, India. The essential data for the Cross Sectional study was collected from patient case files using a well-designed patient data collection form.

**ETHICAL CLEARANCE:**
Ethical permission to conduct the hospital based study was obtained from Institution Ethics Committee, Mandya Institute of Medical Sciences and Teaching Hospital, Mandya, Karnataka, India, before commencement of the study (IEC/RP/2016/02/79). Subject confidentiality was maintained during and after data collection.

**INCLUSION CRITERIA:**
- All adult male and female cardiovascular disease patients of age ≥ 65 years.
- Individuals giving consent for study.

**EXCLUSION CRITERIA:**
- Individuals who are not willing to be a part of the study.
- All pregnant women and lactating mothers.
- All patients treated in Out Patient Department.
- Seriously and mentally ill patients.
- Paediatrics.
SOURCE OF DATA:
The patients who satisfied the inclusion criteria were enrolled in the study. A suitably designed data collection form was used to record all the necessary data including patient’s demographic details, present complaints of the patient, past medical history, past medication history, family history, social history (including diet, alcohol/smoking habits, sleep, bowel and bladder, appetite, exercise habit), physical examination, systemic examination, lab investigations done, diagnosis and the treatment given etc. The discharge medications and the adverse drug reaction if any occurred were also mentioned or collected.

STATISTICAL ANALYSIS:
Collecting information was analyzed using Microsoft Office (MS-Word and Excel) 2010. Descriptive data analysis has been performed in the form of frequency and percentage of demographic variables and polypharmacy and related issues were shown as various tables and graphs for better understanding of data. For the analysis of the results, simple percentage calculations were used to arrive at a conclusion of our study. As polypharmacy has no standard definition, we followed definition given by Kaufman and grouped prescribed medications into four groups < 4, 5-9, 10-14 and >15 in admitted prescriptions.

RESULTS:
A total number of 114 case sheets of cardiovascular disease patients admitted to MIMS teaching hospital were analysed. Among these 114 CVD patients, majority of the patients were male n=65 (57.01%) and n=49 (42.99%) were females (Fig No.1). The total patients admitted into hospital were divided into 3 groups 65-74, 75-84, 85-94 (Table No.3). Most common elderly patients admitted during study period were between age group 65-74 years followed by 75-84 years and 85-94 years.

![Fig. No.1: Gender wise distribution of patients.](image)

<table>
<thead>
<tr>
<th>AGE GROUP (YEARS)</th>
<th>NUMBER</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-74</td>
<td>74</td>
<td>64.91%</td>
</tr>
<tr>
<td>75-84</td>
<td>28</td>
<td>24.56%</td>
</tr>
<tr>
<td>85-94</td>
<td>12</td>
<td>10.52%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>114</td>
<td>100%</td>
</tr>
</tbody>
</table>

Out of the 114 cardiovascular disease patients, polypharmacy was observed in 86 (75.43%) patients consisting of 51 (44.73%) males and 35 (30.70%) females (Fig. No.2 and Table No.4). In all age group mean number of drugs prescribed on admission were more than at discharge. On admission, number of drugs prescribed increased as age of patient increased.
We observed a positive correlation between number of days stayed in hospital with an increase in number of drugs. This might be because patients do not respond to treatment so more options of drugs are used by the Physician.

Table No.4 Number of drugs prescribed to elderly patients admitted in department of Medicine.

<table>
<thead>
<tr>
<th>DRUGS</th>
<th>FREQUENCY</th>
<th>MALE</th>
<th>FEMALE</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td></td>
<td>15</td>
<td>13</td>
<td>24.5%</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>8</td>
<td>2</td>
<td>8.77%</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>12</td>
<td>6</td>
<td>15.78%</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>13</td>
<td>6</td>
<td>16.66%</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>4</td>
<td>4</td>
<td>7.01%</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>4</td>
<td>10</td>
<td>12.28%</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>2</td>
<td>4</td>
<td>5.26%</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>3</td>
<td>1</td>
<td>3.50%</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>4</td>
<td>0</td>
<td>3.50%</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>1</td>
<td>2</td>
<td>2.63%</td>
</tr>
</tbody>
</table>

**DRUG-DRUG INTERACTIONS:**

Out of 86 cases, 69 (80.23%) cases are having drug interactions, in which the interactions between the drugs Aspirin and Clopidogrel were more and is of 35.32%, interactions between Antihypertensives and Diuretics (Furosemide+ Enalapril) and is of 12.61% and 45 (19.77%) cases are not having interactions. Even though DIs were identified, treatment was not stopped as in most of the cases, the drug was absolutely necessary for the patient and the benefits of drug therapy outweighed the risk posed by the Drug Interactions (Figure no.13).
DISCUSSION

Better health care services will have a positive impact on health care system. Many studies were conducted to evaluate the value addition of drug therapy management into the patient care in critical care setting but cardiovascular disease patient were rarely focused as the chances of readmission in hospitals and number of days of hospitalisation is found more in cardiac ill patient leading to increase in the number of drugs prescribed for comorbidity associated illness. A drug therapy plan may require discontinuation or addition of a drug as well dosage adjustments and thus requires more complex decision making skills. Determining whether a patient actually requires drug therapy is probably the most intricate problem to identify because the outcomes of the patient’s drug therapy depends upon the patient’s social history as well pathophysiology and pharmacotherapeutics, which is altered due to disease conditions. Drug therapy management is an effective mechanism to facilitate assessment of the indications, effectiveness, and safety of drug products, especially in patients who are using multiple medications due to concurrent diseases (co-morbidities).

Study result shows that male patients admitted were more compared to female and may infer that male are more prone to cardiac diseases compare to female gender. Average age of patients found was between 65-74 years, which indicates that the cardiac conditions found may be chronic in this age group which in turn leads to increase in the number of drugs prescribed. The increase in number of medicines in the admitted elderly patients reveals that these group of patients are diagnosed with new diseases/illness and require prescription of new medication to manage the condition, along with the drugs they were taking for co-morbidities, leading to higher risk of polypharmacy and adverse drug reactions which can cause morbidity and sometimes mortality of the patient.

Our data shows that prevalence of Drug interactions were more in ICCU, RICU and MICU, which may directly affect the outcome of treatment and hospital stay. Clinical pharmacists play a significant role in critical care units for the better treatment outcomes in critically ill patients by deciding right choice of drug and right doses of medications depending on the patient condition. Medication therapy management becomes more important for patients in critical care units, as they require an extra amount of care and consideration as a consequence of complicated and extensive medication regimens.

Polypharmacy is unavoidable as elderly patients usually suffer from many chronic diseases which demand use of multiple drugs resulting in complex regimen. Clinicians remember common drug-drug interactions but it is impracticable for clinicians to remember all the drug-drug interactions and their clinical significance. Though clinician may give such prescriptions by weighing benefits verses adverse effects of drug-drug interactions. It warrants time to time updates on such medications. To reduce burden of drug-drug interactions due to polypharmacy, educational programmes should be taken but it may require a considerable amount of time and close monitoring. Additionally, pitfalls may be encountered if a provider attempts to make multiple changes to a regimen at a single point in time. Therefore, a more rational approach to drug discontinuation might involve tapering a single drug at a time with careful monitoring for symptoms of withdrawal and disease exacerbation. As a general rule, healthcare providers should minimize the number of medications prescribed for older adults, keep the dosing schedule as simple as possible, and limit the frequent number of medication changes. This must be followed by periodic review at specific intervals.

CONCLUSION

Among all admitted patients in ICCU, RICU, MICU and medical wards (male and female) for cardiac problems, patients were suffering mostly from co-morbid conditions and commonly found co-morbid condition was hypertension and diabetes mellitus, which supports the study that polypharmacy is extremely high in Hypertensive and Diabetic patients are more prone to high risk of complications (Drug-Drug Interactions and Adverse drug reactions). Today, most of the hospitals are well connected with information technology. Possibility of dangerous drug-drug interactions cannot be reduced as there is no regularly updated or online Computer assisted drug-drug interaction checker software. There is need of increase in awareness of potentially inappropriate medication for elderly patients as listed in the Beers criteria.

Harmonizing drug policy and regulatory measures with respect to potentially inappropriate medication use should be a major focus e.g., withdraw harmful medications, establish prescribing limits for the elderly, and approve safer alternatives. Raising physician’s awareness and steps to sensitize higher authorities regarding Polypharmacy and dangerous drug interactions may help to curb irrational prescriptions and ensure safety of the elderly. The use of medicines in a disease condition is necessary, but unnecessary load of drugs to patient will increase the safety problems. Polypharmacy can be avoided by sharing treatment goals and plans. To improve drug safety in this high-risk population, appropriate prescribing might be more important than simply reducing the number of prescribed drugs.

The study highlights the emergency department as a place where potential drug interactions can be identified in high-risk elderly patients. Polypharmacy have shown that they can be effective in improving the overall quality of prescribing with mixed results on distal health outcomes. Polypharmacy has been and always will be common among the elderly population due to the need to treat the various disease states that develop as a patient ages. Unfortunately with this increase in the use of multiple medications comes with an increased risk for negative health outcomes such as higher healthcare costs, ADEs, drug-interactions, medication non-adherence, decreased functional status and geriatric syndromes.
The study concluded that as the patient is having co-morbidities and due to this comorbid conditions it is difficult to treat the existing conditions and leads to polypharmacy which in turn leads to Drug-Drug interactions and adverse drug reactions. This is because, as age increases there will be declination of the physiological processes in the body. Older patients with cardiovascular diseases were prone to have multi-morbidities and polypharmacy, which may increase the risk of Potentially Inappropriate Medication (PIM). The association of cardiovascular diseases with a high risk of PIM in this study seems to support this supposition. In conclusion, we demonstrated in this study that the number of drugs prescribed and the presence of cardiovascular diseases are significant predictors of PIM risk in older patients. Health care professionals should be aware of the risks and cut down unnecessary medications to prevent the polypharmacy from occurring. Physician should prescribe the evidence based medicine (EBM) with rational combinations and clinical pharmacist should provide pharmaceutical care which can prevent the drug related problems caused by polypharmacy. It was observed that at ICU checking of Drug Interactions (DIs) was not in practice. Clinical Pharmacist as a healthcare member can help check DIs in better drug therapy management.

Clinical pharmacists can play a major role prevention and management of polypharmacy that extend beyond the traditional dispensing of medicines. The strategies outlined above, such as use of a risk stratification tool and application of palliative care principles, represent initial steps forward to reduce polypharmacy. The presence of clinical pharmacists in medical rounds could assist physicians in optimizing patients' pharmacotherapy. Clinical Pharmacists must share responsibility with prescribers and patients to ensure that potentially inappropriate medications are minimized, appropriate medications and doses are used, side effects are not treated with more medication without first investigating medication-related causes, and pill burden is minimized. Moreover, clinical pharmacists may reduce adverse effects and medication errors insofar as they contribute significantly to the detection and management of drug related problems, not least in patients with cardiovascular diseases, who have the highest rank in the frequency of polypharmacy which leads to drug interactions, medication errors and potential adverse drug reactions. Polypharmacy of other chronic diseases can also be done necessary to make prescriptions more rational in elderly population.

**RECOMMENDED FUTURE RESEARCH:**

- This study may be helpful in identifying the new concept of drug therapy management of patients with different disease conditions in critical care and also introduce the new concept of drug therapy management in Karnataka state, India.
- Drug utilization evaluation studies of medication therapy can be done to assess the burden of cardiovascular diseases in the population to avoid unnecessary use of medications.
- Pharmacoepidemiological studies can be done to study the uses and effects of drugs in well-defined populations.
- To evaluate the health care outcomes of the patient. The research investigators thought that this type of research should be carried out for longer period of time (for not less than six months) so that we can extrapolate different research ideas in polypharmacy and drug drug interactions. The clinician feedback with regarding to drug drug interactions may help us how we can design interventional research study on drug drug interactions in future.

**LIMITATIONS OF THE STUDY:**

- The external validity of the study may have also been limited by the small sample size, short study duration and follow-up.
- This is the first type of attempt to polypharmacy in our setting. Monitoring patients for longer period would reflect more accurate profile of the natural time frame of the medication views and effects. Also, this study includes the patients of cardiovascular disease only.

**CONFLICT OF INTEREST:**

All the authors declare that there is no conflict of interest in the study.

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LIST OF ABBREVIATIONS USED
CVD : Cardiovascular Disease
WHO : World Health Organization
ADR : Adverse Drug Reaction
DI : Drug Interaction
OTC : Over the Counter
ADE : Adverse Drug Event
MAI : Medication Appropriateness Index
STOPP : Screening Tool of Older Persons Potentially Inappropriate Prescriptions
START : Screening Tool to Alert Doctors to the Right Treatment
DTM : Drug Therapy Monitoring
ICCU : Intensive Critical Care Unit
RICU : Respiratory Intensive Care Unit
MICU : Medical Intensive Care Unit

REFERENCES