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Prevalence and Characteristics of Drug-Drug Interaction Among Hospitalized Geriatric Patients At A Tertiary Care Hospital

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ABSTRACT: This study aimed to assess the prevalence of drug-drug interactions (DDI) in geriatric patients at a tertiary care hospital. A prospective observational study was done on 103 hospitalized patients at a teaching tertiary care hospital. All medically relevant information was noted in a pre-defined data collection form. Alternatively, the demographic data and the detailed history of patient regarding past, present, family, personal and drug history was documented over a span of six months. Patients of both genders who are admitted into the in-patient wards in the Hospital, in age greater than 40 years are include in the study. All of the drug interactions recorded in the study evaluated for their percentages; as well as probability and severity. The study conducted was based on the data collected from 103 patients in this study, 58.25% (n=60) of data were collect from male patients and 41.74% (n=43) from female patients. 45.63% of patients were in ages more than 70 years old. Patients in this study found with different history of diseases, they are arranged in the order as most common Respiratory Tract Diseases (59.22%). Evaluation of patients based on the Prevalence of diseases for which they were hospitalized was classified as Respiratory Tract Diseases (54.36%), Gastrointestinal Diseases (39.8%), Infectious (Include Viral) Disease (68.93%). Overall 103 patients in this study 25 patients were observed to have drug interactions (24.27%). 16.6% of male patients diagnosed with interactions and 34.8% of female patients had history of interactions on their charts. Insulin, heparin and spironolactone had the highest rate of interaction among patients. Based on category and classification of drugs, these interactions were more belong to the anti-platelets, Adrenergic Agents (22.2%). According to severity, 52.7% were moderate. According to probability 50% were probable DDI. According to the study result most of interaction occurred in patient with poly-pharmacy mostly in ages more than 70 years old and showed that as the number of drugs increases in a prescription, the number of DDIs also increases. A thorough knowledge of these can decrease the incidence of DDIs, particularly during the prescription of multiple medications. Most of the drug - drug interactions are preventable.
KEYWORDS: Drug-drug interaction, DDI, Geriatric, Poly-pharmacy, Hospitalized patients.

I. INTRODUCTION

A drug–drug interaction (DDI) is defined as a pharmacokinetic or pharmacodynamic influence of drugs on each other, which may result in desired effects, in reduced efficacy and effectiveness or increased toxicity. DDIs may lead to adverse drug reactions that can be severe enough to necessitate hospitalization. The geriatric population is commonly hospitalised as a result of co-morbidities, therefore a high prevalence of poly-pharmacy exists (10); which could increase the risk of a medication error. Medication errors which included adverse drug events (ADE) and drug-drug interactions (DDI) have become critical issues in public health. It is reported that annually many patients die from a medication error and this costs the patients and insurance companies (3). Poly-pharmacy is defined by the World Health Organization as "the administration of many drugs at the same time or the administration of an excessive number of drugs" and continuous poly-pharmacy is limited to medications taken for prolonged and regular periods. As the latter is the most important risk factor for DDIs (10). The factors which are significantly associated with having 1 or more potential interactions include: taking five or more medicines, patient age of 60 years or older and those suffering from cardiovascular diseases (2). The agerelated change affecting drug excretion translates into a diminished renal drug clearance corresponding with the decline in creatinine clearance, hepatic blood flow and drug metabolism or greater

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sensitivity to adverse drug reactions(5). Drug-Drug Interactions (DDIs) are estimated to account for 6%- 30% of all the adverse drug events and they continue to pose a significant risk to the patient health outcome and a considerable economic burden on the health care system.

II. OBJECTIVE

- To assess the prevalence of drug- drug interactions in old age patients.
- To evaluate drug interactions based on the patients gender.
- To study the reason for admission of geriatric patients in hospital.
- To evaluate the severity and probability of drug-drug interactions.

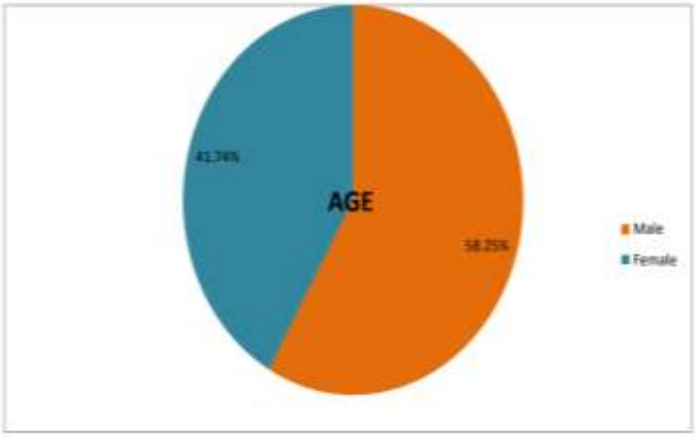
III. METHODOLOGY

This clinical study was done on 103 hospitalized patients at Bangalore Baptist Hospital over a span of six months where data was collected from patients those are of age 40 years or older among both gender and evaluated to assess any drug interaction in their prescription during hospital stay. The was data collected from patient medication chart, patient case reports, nurse's reports and notes, doctor's daily reports and laboratory reports. All medically relevant information was noted in a predefined data collection form. At the end of data collection, all of details were used to calculate the result of study in suitable excel form. Therefore all of the drug interactions recorded in the study evaluated for their percentages according to objectives which is mentioned in previous pages; also they were evaluated based on the probability and severity as well as based on the genders and past medical history and diagnosis.

IV. OBSERVATIONS

Classification of Patients Based on the Gender :
Based on the data collected from 103 patients in this study, 58.25% (n=60) of data were collect from male patients and 41.74% (n=43) of data were collect from female patients.

GENDER	NUMBER (N)	PERCENTAGE
Total	103	100
Male	60	58.25
Female	43	41.74



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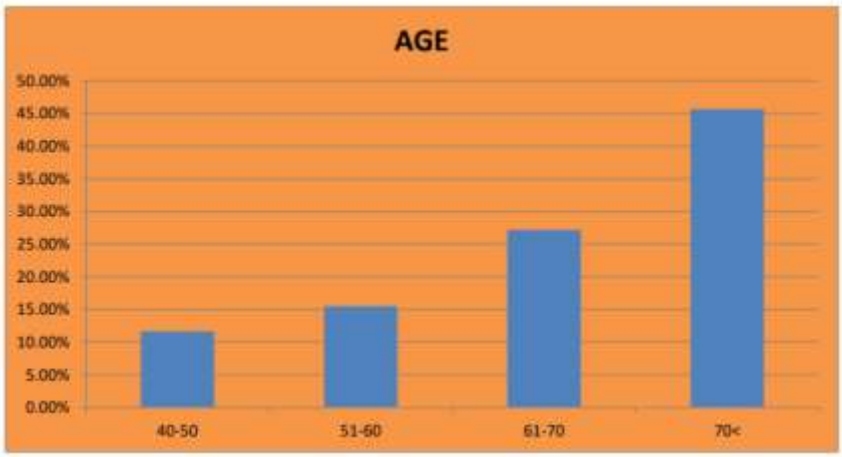
Classification of Patients Based on the Age :

Patients in this study also classified into four groups, 11.65 % of patients were in ages between 40 to 50 years old, 15.5% of patients were between 51 to 60 years old, 27.18% of patients were between 61 to 70 years old and 45.63% of patients were in ages more than 70 years old. In this study most of patients belong to ages more than 70 years for evaluation of interactions.

AGE	NUMBER (N)	PERCENTAGE
40-50	12	11.65
51-60	16	15.5
61-70	28	27.18
70<	47	45.63



Evaluation of Patients Based on the Patients Past History of Disease :

Patients in this study, found with different history of diseases they are arranged in the order as Respiratory Tract Diseases (59.22%), Infectious (Include Viral) Disease (54.36%), Gastrointestinal Diseases (39.8%), Urinary Tract Diseases (16.62%), Cardiovascular Diseases (33%), Endothelial and Metabolism Diseases (12.62%), Nerve System Diseases (14.56%), Muscle And Skeletal Diseases (16.5%), Accident Conditions (7.76%), Surgery (5.82%) and other rare conditions (10.67%) which are not included in the above categories.

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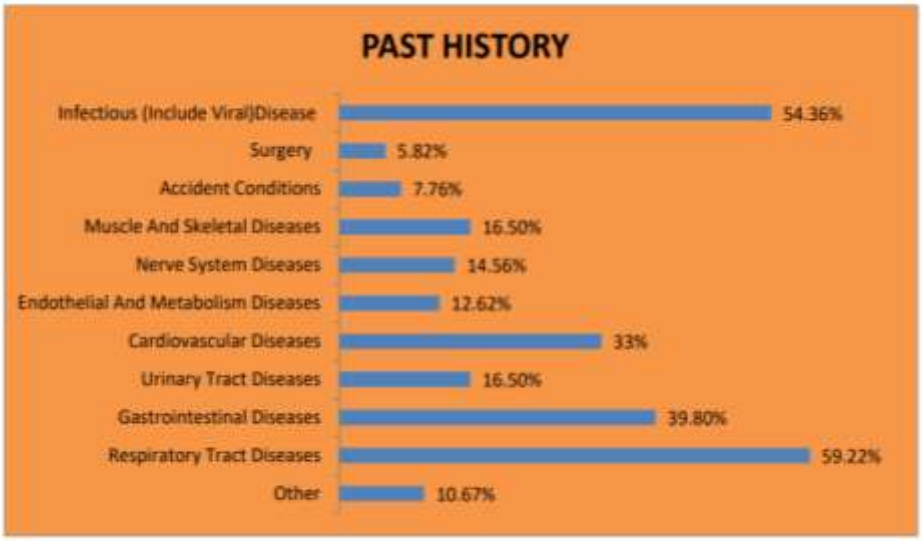
PAST HISTORY	NUMBER (N)	PERCENTAGE
Respiratory Tract Diseases	61	59.22
Gastrointestinal Diseases	41	39.8
Urinary Tract Diseases	17	16.5
Cardiovascular Diseases	34	33
Endothelial And Metabolism Diseases	13	12.62
Nerve System Diseases	15	14.56
Muscle And Skeletal Diseases	17	16.5
Accident Conditions	8	7.76
Surgery	6	5.82
Infectious (Include Viral)Disease	56	54.36
Other	11	10.67



Most common diagnoses among the hospitalized geriatric population :

Evaluation of patients based on the diagnosis of diseases they had hospitalized for treatment, they are classified for as Respiratory Tract Diseases (54.36%), Gastrointestinal Diseases (39.8%), Urinary Tract Diseases(25.24%), Cardiovascular Diseases (34.95 %), Endothelial And Metabolism Diseases (33%), Nerve System Diseases (12.62%), Muscle And Skeletal Diseases (20.38%), Infectious (Include Viral)Disease (68.93%), Accident Conditions (3.88%), Surgery (2.91%) and some other which are not included in the above categories.

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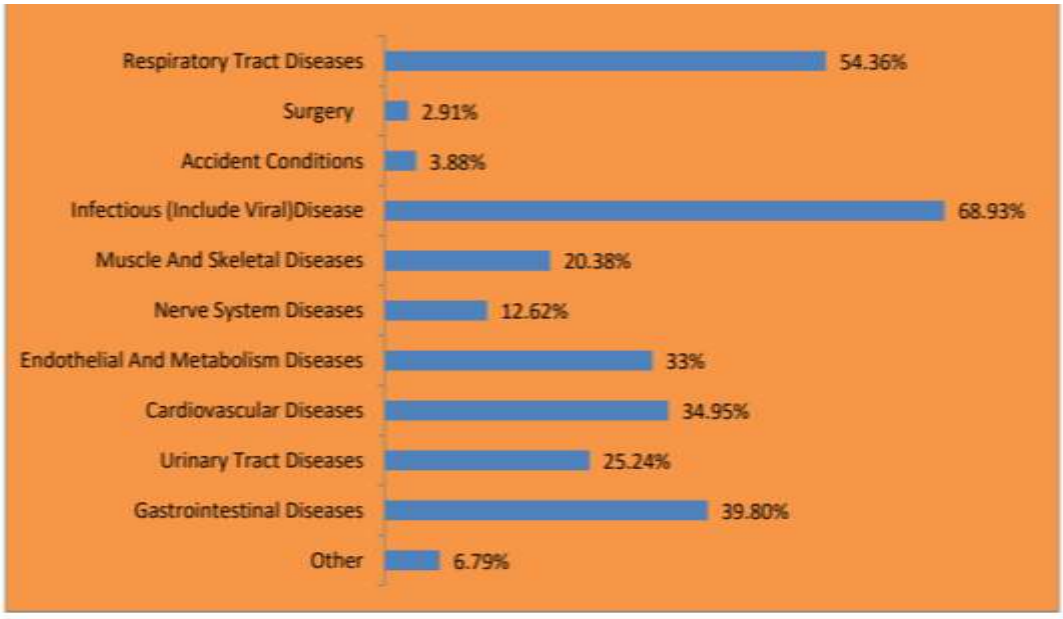
NAME	NUMBER (N)	PERCENTAGE
Respiratory Tract Diseases	56	54.36
Gastrointestinal Diseases	41	39.8
Urinary Tract Diseases	26	25.24
Cardiovascular Diseases	36	34.95
Endothelial And Metabolism Diseases	34	33
Nerve System Diseases	13	12.62
Muscle And Skeletal Diseases	21	20.38
Infectious (Include Viral)Disease	71	68.93
Accident Conditions	4	3.88
Surgery	3	2.91
Other	7	6.79



Prevalence of interactions :

According to data, from 103 patients in this study 25 patients had achieved with interactions (24.27%), and 78 (75.72%) patients had no interactions on their treatment chart, based on this data we can consider that one of each patient had a history of interaction on treatment chart.

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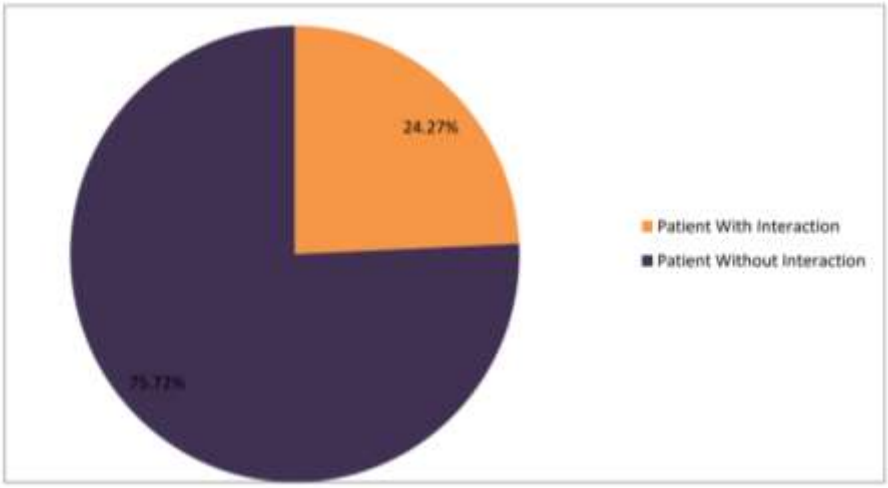
TITLES	NUMBER OF PATIENT(N)	PERCENTAGE
Total Patient	103	100
Patient With Interaction	25	24.27
Patient Without Interaction	78	75.72



Percentage of Interactions in Men and Women :

Evaluation of interactions based on the gender populations of patients; therefore 16.6% of male patients diagnosed with interactions and 34.8% of female patients had history of interactions on their charts.

TITLES	TOTAL(N)	NUMBER (N)	PERCENTAGE
Male With Interactions	60	10	16.6
Female With Interactions	43	15	34.8

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List of interacting drugs :

Total 36 interaction found in this study, these drugs made interactions are includes as carvedilol (5.55%), Formoterol +budesonide (2.7%), atenolol (2.7%), levodopa (2.7%), furosemide (5.55%), aspirin (22.2%), clarithromycin (5.55%), diclofenec, ditiazam (5.55%), metoprolol (2.7%), insulin (11.1%), prednisolone (5.55%), atorvastatin (5.55%), theophylline (5.55%), phenytoin (2.7%), potassium chloride (5.55%), heparin, spironolactone (8.33%), norepinephrine (2.7%), bisoprolol (5.55%), ondansetron (2.7%), ciprofloxacin (5.55%), amiodarone (2.7%), celecoxib (2.7%), fluconazole (2.7%), azithromycin (2.7%), linezolid (2.7%), ramipril (2.7%), ticagnelor (2.7%), hydrocortisone (2.7%), folic acid (2.7%), clopidogrel (5.55%), pantoprazole (5.55%), glimepiride (2.7%), telmisartan (5.55%), enoxaparin (2.7%), deflazacort (5.55%) and metformin (2.7%). Insulin, heparin and spironolactone had the highest rate of interaction among patients in this study.

DRUG NAME	NUMBER OF INTERACTIONS (N)	PERCENTAGE
TOTAL INTERACTIONS	36	100
CARVEDILOL	2	5.55
FORMOTEROL +BUDESONIDE	1	2.7
ATENOLOL	1	2.7
LEVODOPA	1	2.7
FUROSEMIDE	2	5.55
ASPIRIN	8	22.2
CLARITHROMYCIN	2	5.55
DICLOFENEC	1	2.7
DITIAZAM	2	5.55
METOPROLOL	1	2.7
INSULIN	4	11.1
PREDNISOLONE	2	5.55

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ATORVASTATIN	2	5.55
THEOPHYLLINE	2	5.55
PHENYTOIN	1	2.7
POTASSIUM CHLORIDE	2	5.55
HEPARIN	4	11.1
SPIRONOLACTONE	3	8.33
NOR EPINEPHRINE	1	2.7
BISOPROLOL	2	5.55
ONDANSETRON	2	5.55
CIPROFLOXACIN	1	2.7
AMIODARONE	1	2.7
CELECOXIB	1	2.7
FLUCONAZOLE	1	2.7
AZITHROMYCIN	1	2.7
LINEZOLID	1	2.7
RAMIPRIL	1	2.7
TICAGNELOR	1	2.7
HYDROCORTISONE	1	2.7
FOLIC ACID	1	2.7
CLOPIDOGREL	2	5.55
PANTOPRAZOLE	2	5.55
GLIMEPIRID	1	2.7
TELMISARTAN	2	5.55
ENOXAPARIN	1	2.7
DEFLAZACORT	2	5.55
METFORMIN	1	2.7

Classification of interacting drugs based on their drug class :

This interactions collected in this study were more belong to the antiplatelets, Adrenergic Agents (22.2%), Aldosterone/Angiotensin Agents (16.6%), Diabetic Agents (16.6%) and Antibiotics (13.8%).

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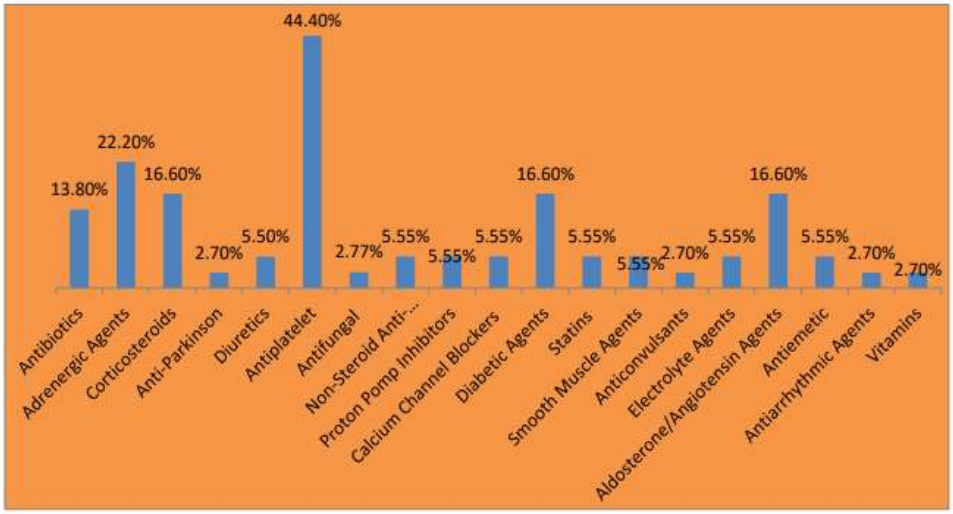
DRUG CATEGORY	NUMBER (N)	PERCENTAGE
Antibiotics	5	13.8
Adrenergic Agents	8	22.2
Corticosteroids	6	16.6
Anti-Parkinson	1	2.7
Diuretics	2	5.5
Antiplatelet	16	44.4
Antifungal	1	2.77
Non-Steroid Anti-Inflammatory Agents	2	5.55
Proton Pomp Inhibitors	2	5.55
Calcium Channel Blockers	2	5.55
Diabetic Agents	6	16.6
Statins	2	5.55
Smooth Muscle Agents	2	5.55
Anticonvulsants	1	2.7
Electrolyte Agents	2	5.55
Aldosterone/Angiotensin Agents	6	16.6
Antiemetic	2	5.55
Antiarrhythmic Agents	1	2.7
Vitamins	1	2.7



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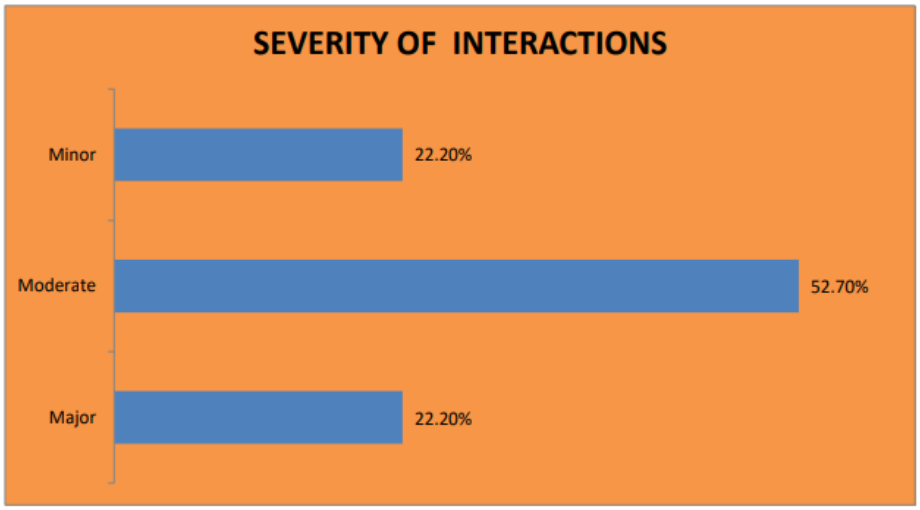
Evaluation of Severity of Drug Interactions :

In this study we evaluated interactions based on the severity of interaction, therefore 22.2% of interaction were major, 52.7% of interactions were moderate and 22.2% were in minor class of interactions.

TITLES	NUMBER OF INTERACTIONS (N)	PERCENTAGE
major	8	22.2
Moderate	19	52.7
Minor	8	22.2



Evaluation of Probability of Drug Interactions :

Interactions based on the probability of drug interaction and the adverse effect found behind them. 22.2 % of these interactions were definite, 50% were probable and 27.7% were possible.

TITLES	NUMBER	PERCENTAGE
Defined	8	22.2
Probable	18	50
Possible	10	27.7

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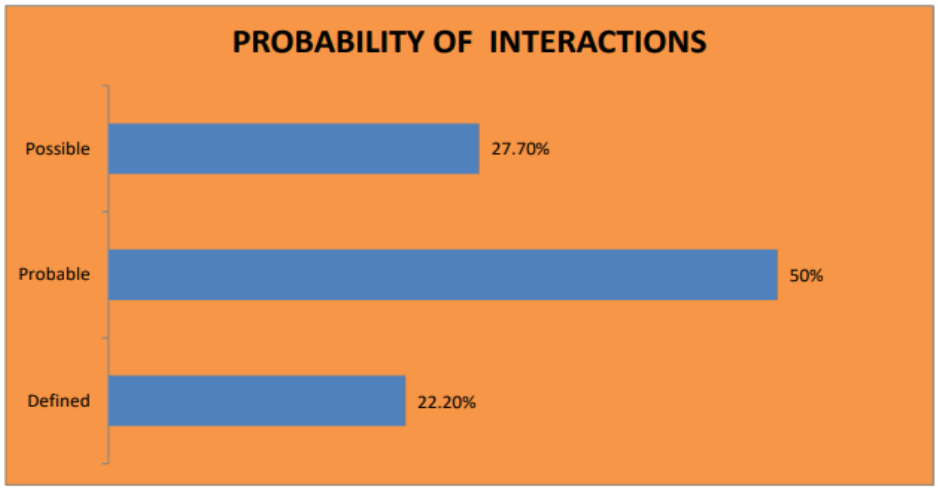

V. DISCUSSION

Based on the data collected from 103 patients in this study, 58.25% (n=60) of data were collect from male patients and 41.74% (n=43) of data were collect from female patients. 45.63% of patients were in ages more than 70 years old. In comparison to **Shahabudin Soherwardi** study the patients in the age group of 56-65 years constituted the highest number of the patients. Also in **Netsanet Diksis** study patient with more than 50 had the highest numbers and the population of male were more than female. Patients in this study found with different history of diseases, they are arranged in the order as most common Respiratory Tract Diseases (59.22%), Infectious (Include Viral) Disease (54.36%), Gastrointestinal Diseases (39.8%), In other hands in evaluation of patients based on the population of diseases they had hospitalized for treatment, they are classified for as Respiratory Tract Diseases (54.36%), Gastrointestinal Diseases (39.8%), Infectious (Include Viral) Disease (68.93%), while in **Shahabudin Soherwardi** study most common diseases were diabetes hypertension and cardiac diseases. Overall 103 patients in these study 25 patients had achieved with interactions (24.27%), 16.6% of male patients diagnosed with interactions and 34.8% of female patients had history of interactions on their charts. While in **Shahabudin Soherwardi** study, 18.66% of the patients had DDIs and on comparing the drug interactions in the two sexes, it was found that males had 61% and females had 64% interactions. In this study Insulin, heparin and spironolactone had the highest rate of interaction among patients or based on category and classification of drugs, these interactions were more belong to the anti-platelets, Adrenergic Agents (22.2%), Aldosterone/Angiotensin Agents (16.6%), Diabetic Agents (16.6%) and Antibiotics (13.8%).; while in **Vijay Kulkarni** study most DDIs are seen between fluoroquinolones and oral anti-diabetics, iron and pantoprazole, aspirin and clopidogrel. According to severity in our study, 22.2% of interactions were major, 52.7% of interactions were moderate and 22.2% were in minor class of interactions, while in **Vijay Kulkarni** study severity assessment showed that majority of the DDIs were moderate (70%) followed by minor (28%). In addition of evaluation drug interactions based on the probability, 22.2 % of these interactions were definite, 50% were probable and 27.7% were possible.

VI. CONCLUSION

According to the study result most of interaction occurred in patient with polypharmacy mostly in ages more than 70 years old and showed that as the number of drugs increases in a prescription, the number of DDIs also increases. The frequently occurring DDIs are seen with Insulin, heparin and spironolactone. This study has put forth the common interactions which we come across in a tertiary care hospital. A thorough knowledge of these can decrease the incidence of DDIs, particularly during the prescription of multiple medications. On the other hand by this way most of the drug-drug interactions are preventable. Clinically relevant drug -drug interactions are common in patients in hospitals and they occur without any understanding. A Pharmacist plays a critical role in detecting and managing this medical problem in hospitalized patients; wile behind role that dosage adjustment is the important point in prevent of drug -drug

interactions and that to be followed in most of the drug-drug interactions.

This study can form a basis for future studies with larger number of patients and follow up for a longer duration of time and which will be reflective of a full population. This study can be improve and better done by doing it in other area and hospitals and comparing them to achieve a clear and broad result about prescribing patterns and evaluations of interactions between drugs in a large area. Interactions and adverse drug reactions are the main problems of many drugs used among patients on their treatment, this adverse effects could keep patients in specific conditions because of their past history and habit of drug use, therefore we need to improve our knowledge about drugs, interactions and their use in different diseases.

VII. LIMITATIONS

- There was a variety of languages between patients; some of patients could not speak English or in some case the language of patients was unknown for other staffs too. This could make a lack of information about background of patients and evaluate of the history about adverse drug reactions.
- Because of covid-19 duration access to some of cases and information of patients were difficulty and non-passible.
- Other limitations were lake of information about background history of medical therapy and disease history of some patients.
- The study was conducted in a single hospital and the results may not be generalized

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