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Drug Utilization Evaluation and Cost of Illness Analysis in Diabetes and Cardiovascular Disease in Tertiary Care Hospital

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ABSTRACT:

Background: Cardiovascular disease (CVD) is a major cause of death and disability among people with diabetes. Diabetes mellitus (DM) has become a rising epidemic in the last century, more pressing in the last few decades with the exponential rise of obesity, and has become one of the leading causes of death worldwide.

Aim: The aim of this study is to Evaluate Drug Utilization Pattern and Cost of Illness Analysis of Diabetes and Cardiovascular Disease.

Methodology: A Prospective observational study With 102 Inpatients from Department of Cardiology and Endocrinology.

Results and Observation: Over all study exhibits 230 drug-drug interaction, most of the drug-drug interaction present in Antiplatelets + Anticoagulants, Antiplatelets + Diuretics and ACE inhibitors + Diuretics etc. In over all COI study expressed, Myocardial infarction patients were more expensive than other CVD and DM patients. 80 percent of medicines were prescribed in National List of Essential Medicine. Drug Utilization Evaluation of Cardiovascular disease and diabetes mellitus as analyzed through the WHO core prescribing indicators like Number of medicines per prescription in this study population as 713(100%) medicines, Number of generic name per prescription in this total study population as 109(15%) medicines, Number of antibiotics per prescriptions in this total study population as 15(2%) , Number of injections per prescriptions in this study population as 114(16%) and Number of essential drugs in this study population as 524(%).

Conclusion: Over all patients were 102 and their prescription had 230 drug-drug interactions. Serious Drug-Drug interactions were 11%, Moderate Drug-Drug interactions were 84%, Minor Drug-Drug interactions were 5%. Most drug-drug interaction were founded in Pharmacodynamic mechanism compared with pharmacokinetic mechanism and the Drug-Drug interaction were founded in Category-C.WHO Core prescribing indicators were used to assess these prescription and these patients prescription were prescribed by the WHO Core prescribing indicators. In CVD and DM patients were prescribed most of the drugs as Antiplatelets, Statin, Anticoagulants like Clopidogrel, Aspirin, Atorvastatin, Rosuvastatin, Heparin sodium etc.

KEYWORDS: Cardiovascular Disease, WHO core Prescribing Indicators, Diabetes Mellitus (DM), Drug Utilization Evaluation (DUE), Potential Drug-Drug Interactions, Cost of Illness Analysis.

I. INTRODUCTION:

"CARDIOVASCULAR DISEASES" (CVDs) refers to a variety of heart andbloodvesselconditions.Thereareotheradditionalunderlyingfactorsthatcontributeto CVDs. These are a reflection of the three main causes — urbanisation, populationageing,andglobalisationthatarecausingsocial,economic,andculturaltransformation.Poverty, stress, and inherited factors are other CVD risk factors. The cardiovascularsystem can experience a wide range of issues, including endocarditis, rheumatic heartdisease, irregularities in the conduction system, and cardiovascular disease (CVD) orheartdisease, amongothers. (1)

Additionally,pharmacologicaltherapy fordiabetes,highbloodlipids,and hypertension is necessary to lessen cardiovascular risk and minimize heart attacks andstrokesin individuals who sufferfrom thesediseases.

The economic cost of CVD include both the costs of general healthcare for theeconomyaswellasthelossofproductivitybroughtonbythecondition.Giventhehigh prevalence of CVD, this economic impact could be significant. Especially in nationswith higher rates of CHD and stroke morbidity. The WHO projects that between 2010and 2030, the cost to the US healthcare budget for people between the ages of 50 and65would

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increasefrom 15%to 25% in 2030. [3]
Although CVD may directly result from a variety of aetiologies, includingrheumatic fever that causes valvular heart disease and emboli in patients with atrialfibrillation that result in ischemic stroke, addressing risk factors associated with thedevelopmentofatherosclerosisiscrucialbecauseitisacommonfactorinthepathophysiologyof CVD.[2]
Hypertension(HTN),CoronaryArteryDisease(CAD),CerebralVascularAccident(CVA),MyocardialInfarction(MI),CongestiveHeartFailure(CHF),AnginaPectoris,Atherosclerosis,AorticStenosis,RheumaticHeartDisease(RHD),IschemicHeartDisease(IHD),CardiacArrhythmia,MitralValveRegurgitationandPericarditis areall included in thecategoryof cardiovasculardisease.[2]

DIABETES MELLITUS:

AccordingtotheWHO,DiabetesMellitus(DM)isclassifiedasaheterogeneous metabolic condition with disturbances in the metabolism of carbohydrates, fats, andproteinsaswellasacommontraitofpersistenthyperglycemia.Diabetesmellitus(DM)is a state of hyperglycemia that has a variety of underlying causes. It is categorisedgenerallyintoType1**"insulin-dependent"**(IDDM)andType2**"non-insulin-dependent"** (NIDDM). [4]
It results from either an insulin deficit, an insulin resistance, or both. Beta cellsin the pancreas release insulin to regulate blood sugar levels. Some of the symptomsthat diabetic people frequently experience include blurred vision, excessive thirst,fatigue,frequent urination, hunger, and weight loss.
Diabetesalsoincreasesthelikelihoodofdevelopingotherillnesses,suchasnon-alcoholicfattyliverdisease,cataracts,erectiledysfunction,peripheralarteryandcerebrovascular disease, heart disease, and obesity. They also have a higher chance ofcontractingsomeinfectiousdiseases,suchtuberculosis.Bloodglucose(orbloodsugar)levels that are elevated in people with diabetes are chronic metabolic conditions thatovertimecausesubstantialharmtotheheart,bloodvessels,eyes,kidneys, andnerves.[5]

TYPE1:InsulinDependentDiabetesMellitus(IDDM)

T1D, also called as the insulin-dependent diabetes mellitus (IDDM), manifestsdue to the autoimmune damage of the B-cells which then leads to the suppression orcessation of insulin production. T1DM is also called the **"Juvenile Onset DiabetesMellitus"**.

Thereisbetacelldestructioninpancreaticislets;majorityofcasesareautoimmune (type 1A) antibodies that destroy beta cells are detectable in blood, butsome are idiopathic (type 1B) no beta cell antibody is found. In all type 1 casescirculating insulin are more prone to ketosis. This type is less common and has a lowdegreeofgeneticpre-deposition.[6]

Type2:Non-Insulindependentdiabetesmellitus(NIDDM)

There is no loss or only moderate reduction inbeta cell mass; insulinincirculation is low, normal or even high, no anti beta cell antibody is demonstrable, hasa high degree of genetic predisposition; generally has a late onset (past middle age).Over90% cases of diabetes aretype2 diabetes mellitus.[6]
Therearetwoissuesbecausetheglucoseisnotadequatelyenteringthebody'scells.

- Abuild-upofglucoseintheblood.
- Glucose,whichthecellsrequireforenergyandgrowth,isnotbeingdeliveredtothem.

GestationalDiabetesMellitus:

Gestationaldiabetesisaconditioninwhichapregnantwomanhaselevatedglucoselevelsandothersymptomsofdiabetes.Duringpregnancy,yourmakeshormonesthatcauseglucosetobuildupinblood.Usually,pancreascansendoutenoughinsulintohandleit.Butbodycan'tmakeenoughinsulinorstopsusinginsulinasitshouldrisesbloodsugarlevels,andgetgestationaldiabetes.Gestationaldiabetesareathigherriskofdevelopingtype2diabeteslaterinlife.[6]

DRUGINTERACTIONS:

"Druginteractionisdefinedasthepharmacologicalactivityofonedrugisalteredbythecon-cominantuseofanotherdrugorbythepresenceofsomeothersubstance.TheDrugwhoseActivityiseffectedbysuchanInteractioniscalledasa"Objectdrug".Theagentwhichprecipitatessuchaninteractionisreferredtoasthe"Precipitant".[7]

TypesofDrugInteractions:

- Drug-Druginteractions
- Drug-foodinteractions
- Chemical-drug interactions
- Drug-laboratory test interaction
- Drug-diseaseinteraction

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COSTOFILLNESSANALYSIS:

Cost of illness (COI), known as burden of disease (BOD), is a definition thatencompassesvariousaspectsofthediseaseimpacto nthehealthoutcomesinacountry,specific regions, communities, and even individuals. A determination of the economicimpactof an illness orcondition.[ChangikJo.etal.,][8]

Costof Illnessincludes:

- Medicalcareforprevention,treatment&Soci al servicesforrehabilitation.
- Productivityloss

The objective of Cost-of-illness (COI) analysis is to evaluate the economicburdenillnessimposeonsocietyasawholeint erms oftheconsumption ofhealthcareresourcesandproductionlosses.Theecon omiccostofillnessrepresentedtheeconomicbenefitsof ahealth careintervention that eradicatedsuch illness.

TypesofCosts:

Direct, indirect, and intangible costs are the three categories into which COIstudies often divide costs. Due to the fact that intangible expenses, as measurementissues and related disputes make it difficult to quantify in COI investigations, we hereprimarilyfocus on thefirst-two priceranges.

DIRECTCOST:

The direct costs, which are borne by the healthcare system, society, families,and individual patients, include medical and nonmedical expenses. The former isdescribed as the costs of medical care for a diagnosis, treatment, and rehabilitation,among other things, whereas the last one is connected to the use of non-healthcareresources such as transportation, living expenses, moving, and property losses andunrecognised cares of anykind.

IN-DIRECTCOST:

In COI studies, the term "indirect" occasionally refers to productivity lossescaused by morbidity and mortality, which are borne by the individual, family, society,ortheemployer.Incontrasttoaccountingandm ostbusinessdisciplines,where"indirect" costs indicate the supporting and overhead activities that need to be sharedamong the users. It has been advised to replace the word with "productivity losses orproductivitycosts"toeliminateanyconfusionorunce rtaintyreaders mayexperience.[8]

DRUGUTILIZATIONEVALUATION:

According to WHO, Drug Utilization evaluation is defined as the marketing,distribution, prescription and use of drugs in society, with special emphasis on theresultingmedical,social andeconomicconsequences.[2] DrugUtilizationReviews(DUR),alsoreferredtoasDru gUtilizationEvaluations (DUE) or Medication Utilization Evaluations (MUE), are defined as anauthorized, structured, ongoing review of healthcare provider prescribing, pharmacistdispensing, and patient use of medication. DURS involve a comprehensive review ofpatients'prescriptionandmedicationdatabefore,dur ing,andafterdispensingtoensureappropriatemedicati ondecisionmakingandpositivepatientoutcomes. [10]

Drug Utilization Evaluation (DUE) is an ongoing authorized and systematicqualityimprovementprocess,designedtoo ptimizedrugusebydevelopingcriteriaandstandards.

- ToeducateclinicansandotherHealthCareProfes sionals(HCP),toincreaseappropriatedruguse.
- Toprovidefeedbackofresultsobtainedduringstud ytocliniciansandotherHealthCareProfessionals.
- To reviewdruguse.
- Toanalyzeprescription pattern.
- Todevelopandstandardswhichdescribesoptimal druguse.
- Promoteappropriatedrugusethrougheducationa ndotherinterventions.[11]

OBJECTIVE:

- To understand the Prescribing Pattern of Drugs used in Cardiovascular Disease and T2DM, Promote patient awareness about the diseases.
- To Evaluate The Potential Drug – Drug Interactions (PDDIs).
- To Identify The Rationality of Drug Prescribed For CVD And DM Patients.
- To Estimate Cost of Illness Analysis of Cardiovascular Disease and Diabetes Mellitus Individuals.
- To Determine Whether Providing Essential Medicine.
- To Understand The Pattern of Drug Utilization Using WHO Core Prescribing Indicators.

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II. METHODOLOGY:

- **Study Design:**

A prospective Observational Study

- **Study Site:**

The study was carried out at Cardiology and Endocrinology department in Sudha Institute of Medical Science (SIMS).

- **Sample Size:**

A total number of 102 people were included according to inclusion and exclusion criteria.

- **Study Duration:**

The study was conducted for duration of 6 months (March 2022 – August 2022).

- **Study Subjects:**

Patients diagnosed with T2DM accompanying Cardiovascular Disease

- **Study Criteria:**

Inclusion Criteria:

- 25 - 90 years old both male and female patients.
- Patient diagnosed with Type-2 DM and T2DM along with its CVD complications (HTN, Atherosclerosis, CHD, HF, Angina, MI and stroke) during the study period.
- Patients who are willing to participate in the study.

Exclusion Criteria:

- Patient below 25 years.
- Pregnant women and lactating women.
- Patient diagnosed with CVD and Type-2 DM Combined with other co- morbidities.
- Vulnerable populations without geriatrics.
- Patients who did not agree to participate in the study.
- Observation with illegible information were excluded

PLAN OF THE STUDY:

Preparation of protocol and Data collection form

↓

DCF was validated by Pharmacist

↓

Approval of IEC clearance

↓

Data was collected from patients/Caretaker staying in the hospital by interviewing and filled in DCF accordingly

↓

Data was analyzed using Microsoft Excel 2013

↓

DUE of CVD and DM and cost of illness was assessed and the results were interpreted

METHODS OF EVALUATION DIRECT AND INDIRECT HEALTHCARE COSTS:

- Doctor consultation fees
- Laboratory investigation cost
- Medicine cost
- Room services cost
- Food charges
- Surgery cost&Travelling charges of patient's Attender

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STATISTICAL ANALYSIS:

Statistical Analysis was done by entering the data into Microsoft Excel spreadsheet (version 2013) and analysed using Microsoft Excel and represented as number and percentage, and the Mean, Standard Deviation was also performed.

III. RESULTS & DISCUSSION:

There are many variations in prescribing patterns of Diabetes mellitus withhypertension which requires lifelong treatment as enormously increased the burden ofchronic diseases and needs much care while choosing drugs. In a tertiary care centre,prescribing pattern are powerful tools to ascertain the role of drugs in society. Hence,there is a need for appropriate, safe, effective and economical study to find out thepatternsofdrugtherapyamongdiabetichypertensivepatientswithothercomplications.

Table1:Agewisedistributionof cardiovasculardiseaseandDiabetesMellitus:

Agein years	DemographicData		
	NumberofCVandDMPatients(n=102)		
	Male	Female	Total
31 to 40	2(3%)	3(11%)	5(5%)
41 to 50	20(27%)	6(22%)	26(25%)
51 to 60	25(33%)	7(26%)	32(31%)
61 to 70	18(24%)	8(30%)	26(25%)
71 to 80	8(11%)	3(11%)	11(11%)
81 to 90	2(3%)	0%	2(2%)
Total	**75**	**27**	**102**

In this study total no of population were 102 and the male patient were 75 and femalepatient were 27. The Age wise distribution represents in Cardiovascular diseaseandDiabetes mellitus , themale patientwereaffected in 33%under 51 to 60 age groupand female patient were affected in 30% under 61 to 70 age group . Most of the CVDandDMpatientswereaffectedattheagegroupof51to60.Inthatmales(33%)patientmorethan thefemalepatient (26%).

Table:2GenderwiseDistribution:

Gender	Total Number of StudyPopulation(n=102)	Percentage(%)
Male	75	74%
Female	27	26%

Table 2 represents the total no of study population were 102 and male patientswere75(74%)andfemalepatientswere27(26%)inCardiovasculardiseaseandDiabetesmellitus.

Table:3Co-morbiditiesin thestudypopulation

Co-Morbidities	Number. of patients (n=102)	Percentage(%)
DM	16	16%
HTN	15	15%
DM,HTN	9	9%

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HTN,CAD	1	1%
CAD	3	3%
CAD,DM	1	1%
DM,HTN,CAD	4	4%
NoCo-Morbidities	53	52%

InthisstudyrepresentstheCo-MorbiditiesasDM(16%),Hypertension(15%),Coronary artery disease(3%), DM + Hypertension(9%), Hypertension + Coronaryarterydisease(1%),Coronaryarterydisease +DiabetesMellitus(1%),DM+Hypertension+ Coronary artery disease(4%)and No Co-Morbiditiesas 52%ofpatients.Most of the patientsaffected theDM Co-Morbidities(16%)
.

Table:4Classificationofdrugsinthecardiovasculardrugsused

ClassificationsOfDrugs	NumberofCardiovasculardrugs(n=470)		Total (%)
	Males	Females	
Diuretics	37(10%)	19(18%)	56(12%)
Beta–Blockers	37(10%)	11(10%)	48(10%)
AceInhibitors	17(5%)	9(8%)	26(6%)
Calciumchannelblockers	9(2%)	2(2%)	11(2%)
Alpha–Blockers	1(0%)	0(0%)	1(0%)
Angiotensin-2Inhibitors	11(3%)	5(5%)	16(3%)
Statins	69(19%)	13(12%)	82(17%)
Vasodilators	6(2%)	4(4%)	10(2%)
AntiplateletDrugs	127(35%)	22(21%)	149(32%)
Anticoagulant	48(13%)	16(15%)	64(14%)
DigitalisGlycosides	0(0%)	2(2%)	2(0%)
Others	2(1%)	3(3%)	5(2%)
Total	364	106	470

Table-4 represents the diuretics drugs prescribed in male(10%) and female(18%),Betablockers prescribed in male (10%) and female (10%), ACE inhibitors prescribed inmale(5%)andfemale(8%),CCBprescribedinmale(2%)andfemale(2%),AlphaBlockersprescribedinmale(0%)andfemale(0%),Angiotensin–2Inhibitorsprescribedinmale(3%)andfemale(5%),Statinsprescribedinmale(19%)andfemale(12%),Vasodilatorsprescribedinmale(2%)andfemale(4%),Antiplateletprescribed in male(35%) and female(21%), Anticoagulants prescribed in male(13%)and female(15%),Digitalis glycosides didn't prescribed in male and prescribed infemale(3%),Othercardiovasculardrugsareprescribedin male(1%)andfemale(3%)

Table:5ClassificationofDiabetesmellitusdrugs

ClassificationsOfDrugs	Numberof AntidiabeticDrugs(n=35)	
	Males	Females

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Sulphonylureas	4(14%)	1(17%)
Biguanides	21(72%)	3(50%)
Insulin	4(14%)	2(33%)

Table-5 represents most of the DM patients treated to the Biguanides drugs prescribedin Male (72%) and Female (50%), Sulphonylurease prescribedin Male (14%) andFemale (17%) ,Insulinprescribed inMale(14%) and Female(33%).

Table:6ClassificationsofNon-CardiovascularDrugs

Classof Non-Cardiovasculardrugs	**Number of Non –CardiovascularDrugs(n=189)**
NSAID's	21(11%)
Antibiotics	15(8%)
Antihistamines	54(29%)
PPI	22(12%)
Sedativedrugs	16(8%)
Antiemetic	7(4%)
Others	54(29%)

Table 6 represents the non-cardiovascular drugs prescribed in Cardiovascular diseaseandDiabetesmellituspatientslikeNSAIDswere11%(21drugs),Antibioticswere8%(15 drugs) , Antihistamine were 29%(54 drugs), PPI were 12%(22 drugs),Sedativedrugswere 8%(16 drugs), Antiemetic were 4%(7 drugs) and others were 29%(54drugs)and total no of non-cardiovasculardrugsused 189.

Table: 7 Cost Of Illness Analysis both Direct and Indirect Cost of Myocardial Infarction in CardiovascularDisease:

Disease		**Average perpatient(inrupees)**	**MyocardialInfarction(inrupees)**
DirectCost	ConsultationFee	3896	171400
	DiagnosticCost	16627	731590
	RoomCost	7381	324750
	MedicineCost	1816	79,919
	FoodCost	2607	114700
	Surgery	839386	36933000
	Others	15886	698993
	TravelCost	890	39,160
IndirectCost		4034	177500
TotalCost		892523	39271012

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Inthisstudyrepresentscost-of-illnessanalysisofCardiovasculardiseasepatientsand their total direct costsin rupees (39,093512) like consultation fees(1,71,400), Diagnostic cost(7,31,590), Room cost(3,24,750), Medicine cost(79,919),Food cost (1,14,700), Surgery cost (3,69,33,000),Travel cost(39,160) and others likedurationofdrugusagewages(6,98,993)andindirectcostofDMpatientswere1,775,00rupees.

Table: 8TypeofDrug-druginteraction

DrugInteraction	**Outcomes**	**Mechanisms**	**Number ofdruginteraction (%)**
Antiplateletdrugs +Anticoagulant	Increased risk ofbleeding	Pharmacodynamicmechanism	39(29%)
Antiplateletdrugs +Diuretics	ClopidogrelincreaselevelsofTorsemidebyslowingthedrug metabolism	Pharmacokineticmechanism	29(19%)
ACE-inhibitors+Antiplatelet Therapy	Combining this drugsincreasestheriskof high potassiumbloodlevels	Pharmacodynamicmechanism	17(11%)
ACEInhibitors+Diuretics	Combining this bothdrugsmaycauselow blood pressure andreducekidneyfunction	Pharmacodynamicmechanism	15(10%)
Betablockers +Diuretics	AtenololincreasesandTorsemide decreasethepotassiumlevelsintheblood	Pharmacodynamicmechanism	15(10%)
PPI + Antiplatelets	Clopidogreltakeninthiscombinationmay inhibitplateletaggregation(Increased riskofbleeding)	Pharmacokineticdrug metabolism	8(5%)

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Antiplatelet +ARB	Telmisartanandaspirinbothincreasethepotassiumlevelintheblood, may reducethekidneyfunctionandparticularly in elderly orvolume depletedindividuals	Pharmacodynamicmechanism	7(5%)
Anticoagulant +ACEInhibitors	Heparin and Enalaprildrugs increase the riskof highpotassiumlebvelsinthe blood	Pharmacodynamicmechanism	7(5%)
ARB+Statins	Telmisartan and Atorvastatin may	Pharmacodynamicmechanism	7(5%)

In thisstudy represents most of the CVD and DM patients were affectedAntiplatelet+Anticoagulantdrug-druginteraction(39),inadditionAntiplatelet+Diuretics drug-drug interaction (29)and least drug-drug interaction class were ACEinhibitors+Biguanides (6).

Table:9SchemeUtilization

Schemeutilization	Male	Female	Total	Percentage
Cash	54	18	72	71%
Scheme	21	9	30	29%

Table9representsthetotalstudypopulationiscashusageis71%andschemeutilizationis 29%.

Table:10variousdrugsprescribedfordiabeteswithCardiovascularDisease

ClassofDrugs	Drugs	Number.ofDrugs(N=429)	Percentage(%)
Betablockers	AtenololMetoprololCarvedilol BisoprololLabetalol	2 29 10 5 1	0.5% 7% 2% 1% 0.23%
ARB	Losartan Telmisartan	2 14	0.5% 3%
Vasodilators	Isosorbide mononitriteNitroglycerine	1 1	0.23% 0.23%
Antiplatelet	ClopidogrelAspirinPrasugrelTicagrelor	40 75 13 27	9% 17% 3% 6%

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Statin	Rosuvastatin Atorvastatin	8 7	2% 2%
AntiHyperlipedimic Agents	Ezetimibe	1	0.23%
Diuretics	TorsemideFurosemide	27 8	6% 2%
Cardiacglycosides	Digoxin	2	0.5%
ACEinhibitors	Enalapril Ramipril	24 1	6% 0.23%

Table 10 represents the Diabetes mellitus with cardiovascular disease patientsprescribed drugs are Beta blockers, ARB ,Vitamins, Antiplatelet ,Statin, Antibiotics,NSAIDs,PPI,Anti-histamines,Anti-psychiatrics,Anticoagulant,Antiemetic,Vasodilators ,Diuretics also.

Table:11CategorywisedistributionsofDrugInteractions

CategoryOfDrugInteraction	**Numberof DrugInteractions(n=230)(%)**
Serious	25(11%)
Moderate	194(84%)
Minor	11(5%)

Over all this study represents most of the patients affected in moderate Druginteractionswere84%(194),inaddition seriousdruginteractionswere11%(25)andfinallyMinor druginteractions were5%(11).

Table:12TotalcostofdirectandIndirectinCardiovascularDisease

Disease	**Direct cost(inrupees)**	**Indirect cost(inrupees)**	**Total(inrupees)**
Hypertension	35,139		35,139
CompleteHeartBlock	64,004		64,004
Myocardialinfarction	5,893,132	198,000	6,091,132
MyocardialInfarction+CompleteHeart Block	355,744		355,744
Atherosclerosis	37,059		37,059
AcuteCoronarySyndrome	536,554	13,800	550,354
Angina	255,090	10,700	265,790
CoronaryArteryDisease	3,569,365	328,000	3,897,365
DilatedCardioMyopathy	130,330		130,330
SupraventricularTachycardia	23,886	3,500	27,386
CongestiveCardiacFailure	127,438	7,000	134,438
Total			**11,390,741**
Average			**1,898,457**

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Median			**134,438**
StandardDeviation			**1966359.545**

Table 12 represents cost of illness analysis direct and indirect cost (in rupees) ofCardiovascular disease study population, mean ± SD of this COA of cardiovasculardisease study population is**1,898,457** ±**1,966,359**. COA of this cardiovasculardiseasestudypopulationmostcostutilizestheMyocardialinfarctionpatientscomparedwithother cardiovascular diseasepatients.

Table:13TotalCostsofDirectandIndirectinDiabetesMellitus

Disease		**DiabetesMellitus(n=4)(InRupees)**
DirectCost	ConsultationFee	12,600
	DiagnosticCost	15,120
	RoomCost	22,750
	MedicineCost	49,525
	FoodCost	8,000
	Surgery	18,000
	Others	19,953
	TravelCost	1,400
IndirectCost		9,000
TotalCost		1,56,348

Inthisstudyrepresentscost-of-illnessanalysisofDiabetesmellituspatientsandtheirtotaldirectcosts(1,47,348rupees)likeconsultationfees(12,600rupees),Diagnostic cost(15,120 rupees), Room cost(22,750 rupees), Medicine cost(49,525rupees), Food cost (8,000 rupees), Surgery cost (18,000 rupees),Travel cost(1,400rupees) and others like duration of drug usage wages (1,400 rupees) and indirect costofDM patients were9,000 rupees.

Table:14TotalcostsofDirectandIndirectofcardiovascularwithDiabetes Mellitus

Disease	**Directcost(InRupees)**	**Indirect cost(InRupees)**	**Total(InRupees)**
DiabetesMellitus+ Hypertension	3,000	3,000	6,000
DiabetesMellitus+Mitral ValveReplacement	158,992	3,000	161,992
DiabetesMellitus+Angina	55,117	4,800	59,917

Table16representsasDM+HTNcostis6000rupees,DM+Mitralvalvereplacementcost is161,992 rupeesandDM+Angina costis 59,917rupees.

Table:15DrugUtilizationEvaluationofCardiovasculardisease

WHOcoreprescribingindicators	**CardiovascularDiseases**
No.ofMedicines/Prescriptions	671
No.ofGenericname/ prescriptions	106
No.ofAntibiotics/prescriptions	9

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No.ofInjections/prescriptions	95
No.ofEssentialdrugs	491

In this study represents Drug Utilization Evaluation of Cardiovascular diseaseas analyzed through the WHO core prescribing indicators like No of medicines perprescription in CVD study population as 671 medicines, No of generic name perprescriptioninCVDstudypopulationas106medicines,NoofantibioticsperprescriptionsinCVDstudypopulationas9,NoofinjectionsperprescriptionsinCVDstudypopulation as 95and No ofessential drugsin CVDstudypopulation as 491 .

Table:16DrugutilizationevaluationsofDiabetesmellitusinstudy Population

WHOcoreprescribingindicators	Diabetesmellitus
No.ofMedicines/Prescriptions	24
No.ofGenericname/ prescriptions	0
No.ofAntibiotics/prescriptions	4
No.ofInjections/prescriptions	10
No.ofEssentialdrugs	17

Table16representsDrugUtilizationEvaluationofdiabetesmellitusasanalyzedthroughtheWHOcoreprescribingindicatorslikeNumberofmedicinesperprescriptioninDMstudypopulationas24drugs,Numberofantibioticsperprescriptionsin DM study population as 4drugs,Numberofinjectionsperprescriptionsin DM study population as 10 drugs and Number of essential drugs in DM studypopulationas 17drugs.

Table:17DrugUtilizationEvaluationofCardiovasculardiseaseandDiabetes Mellitusinthis

WHOcoreprescribingindicators	Numberofdrugs	Percentage
No.ofMedicines/Prescriptions	713	100%
No.ofGenericname/prescriptions	109	15%
No.ofAntibiotics/prescriptions	15	2%
No.ofInjections/prescriptions	114	16%
No.ofEssentialdrugs	524	73%

Table 17 represents Drug Utilization Evaluation of Cardiovascular disease anddiabetesmellitusasanalyzedthroughtheWHOcoreprescribingindicatorslikeNumberofmedicinesperprescriptioninthisstudypopulationas713(100%)medicines,Numberof generic name per prescription in this total study population as 109(15%) medicines,Number of antibiotics per prescriptions in this total study population as 15(2%) ,Number of injections per prescriptions in this study population as 114(16%) andNumberofessential drugs in this studypopulationas 524(%) .

IV. CONCLUSION:

- In the present study it was observed that cardiovascular disease was more common in male compared to female and the risk for CVD increased with increasing age. In the present study, the prevalence of coronary artery disease was high.
- The most commonly prescribed categories of cardiovascular drugs were Anti hypertensives and Antiplatelets indicating a high prevalence of hypertension and coronary artery disease in patients. Extensive polypharmacy was noticed in the prescriptions.
- Diabetes is a chronic and potentially disabling disease that represents an important public health and clinical concern. This study reflected the actual utilization of different anti-diabetic drug classes in diabetes patients. It was observed that among the anti-diabetic drugs, most frequently prescribed drug was Glimepiride followed by Metformin, Gliclazide, and least prescribed drug was Human Insulin in monotherapy. Surprisingly, none of the prescriptions were in accordance to

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the WHO/ American Diabetic Association (ADA) guidelines for the utilization of anti-diabetics as a monotherapy. It is needless to mention that such guidelines are aimed to achieve a cost effective therapy and for choosing treatment alternatives. Physicians should follow such guidelines so as to attain therapeutic goals.

RECOMENDAT IONS & FUTURE DIRECTIONS

- In future, similar studies can be planned in Government hospital settings. Studies for evaluating defined daily doses (DDD) for anti-hyperglycemic & cardiovascular drugs agents can also be envisaged.
- Further studies from time to time are required in drug prescription pattern and standard treatment guidelines should be circulated amongst practicing physicians to encourage rational prescription.
- This analysis and previous cost effectiveness studies have focused on the influence of traditional risk factors in the development of cardiovascular events, but—because of the increasing prevalence of diabetes—an integrated diabetes-cardiovascular disease approach should be pursued in future.

LIMITATIONS:

- The sample was not random and could have been a potential source of bias.
- This is only Prospective Observational Study if a cross-sectional study in Multiple center studies can demonstrated a Clear idea
- Glycosylated HbA1c was not recorded but recommended in the study

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