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Clinical Pharmacist interventions over Anti-tubercular treatment strategies in Management of Drug Related Problems.

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ABSTRACT:

The Present study aimed in analyzing the impact of clinical pharmacist interventions over anti tubercular treatment strategies in management of drug related problems for the achievement of desired therapeutic outcomes in effective combating of tuberculosis which got approval from District TB Office in Jayanagar 4th Block, Bangalore, Karnataka ,India and data regarding the tuberculosis patients visiting the RNTCP/DOTS centers of PHCs located in North Bangalore (RT Nagar area (Cholanayakanahalli, Sulthan palya, Hebbal),Herohalli,Devanahalli,Yelahanka was collected during May 2022 to May 2024 over a period of 2 years, where a sample size of 999 was analyzed by using PCNE Classification scheme for Drug-Related Problems V9.01 and founded that P1 -673 (67.36) of Adverse drug reactions,P2-105(15.01),Drug choice problems,P2.1-42(4.242) Duplication of therapeutic group, P2.2 -31(3.103) Inappropriate drug Form, P2.3-17(1.701)No clear indication of Drug, P3-9(0.900) Drug use problems, P3.1-104(10.410) Drug overused / over Administered, P4-524(52.45) Drug interaction,P5.1-171(17.11) Insufficient awareness of health and diseases all the details regarding the drug related problems were reported to risk factors and ADR s will be managed monitored documented and reported to RNTCP staff and necessary interventions were carried out in promotion of desired therapeutic outcome to END TB and same reports were sent to state TB Control office for the future references. The Present study concludes that the clinical pharmacist's timely interventions in the Prescription analysis and patient's drug therapy is required for the effective management of drug related problems in promotion of rational drug usage and achievement of desired therapeutic outcomes.

Keywords: Clinical Pharmacist, Tuberculosis, PCNE Classification scheme for Drug-Related Problems V9.01.

Introduction:

The world has been witnessed with various epidemic and pandemic infectious diseases which has affected thousands of lives despite of our high advances in research still we are continued to be always challenged with new pathogens that are posing a threat to human lives, health care system, and global economy.

Tuberculosis (T.B) is defined the infectious disease which is caused by bacterium Mycobacterium [1]. India is a highly populated country and annually accounting for a quarter (25%) of global burden of new T.B cases and it is estimated that 320 000

annual deaths are due to drug resistance in T.B which further accounting for 29% of global mortality. whereas recent evidences and reports has been stating that there is rapid increase in drug resistance T.B cases and found there are so many challenges which were remaining unsolved and playing prominent role causing drug resistant T.B like failure in early detection of drug resistance, failure in achieving patient medication adherence, failure in diagnosis of T.B and defining its cure, co-infections with HIV failure in successful infection control, sub optimal prescribing practices, ADR Management, irrational drug usages etc.,

The main challenges for TB control are inadequate diagnostics and treatment, the need for expansion and successful implementation of the World Health Organization (WHO) Directly Observed Therapy, short course (DOTS) program, prevention of Drug-Resistant TB, HIV co- infection, adverse drug reactions leading patient Medication non-adherence, lack of TB knowledge, stigmatization, Poverty and Malnutrition, poor notification and overall negligence[22,23].

AIM: To Study the Clinical Pharmacist interventions over Anti-tubercular treatment strategies in Management of Drug Related Problems

OBJECTIVE: To conduct the Prescription Analysis and Critical Evaluation of a medication usage by patients to identify report and to monitor the Drug-Related Problems (DRPs) to submit detailed reports on it

METHODOLOGY:

Sample size: 999 (as per the sample size calculation formula)

Study site: PHCs with RNTCP/DOT centers located in North Bangalore (RT Nagar area (Cholanayakanahalli, Sulthan palya, Hebbal), Herohalli,Devanahalli,Yelahanka.

Study duration: 48 months.

Study design: Prospective Interventional Study.

STUDY CRITERIA:

- ✓ **Inclusion Criteria:** All patients who are positive with tuberculosis and visiting PHCs for treatment and willing to participate in the present study.
- ✓ **Exclusion Criteria:** Patients such as Pediatrics, Psychiatric HIV positive and who are not willing to participate in the present study and Patients with default treatment within first 15 days of treatment (early death and early default) or death are excluded.

MATERIALS USED:

- Case Records
- Treatment Charts
- Lab Masters
- Physician Notes
- Patient Medication Rack
- Nurses and physician Comments
- Various databases, tools, scales, leaflets.

Method of Collection of Data: The newly admitted cases in RNTCP/DOT centers of PHCs located in the north Bangalore (RT Nagar area (Cholanayakanahalli, Sulthan palya, Hebbal),Herohalli,Devanahalli,Yelahanka.Patients will be randomly selected on daily basis and reviewed, followed up for the present study. It's a Prospective cohort study where the TB patients will be followed up and Patient Data will be collected through medication therapy chart review of patients maintained in the nursing station of PHC.

Data Analysis: To investigate the rational use of anti tubercular drugs for completeness, legibility and to characterize their usage in PHCs.Data from the prescriptions of patients attending RNTCP/DOT centers of PHCs located in the north Bangalore(RT Nagar area (Cholanayakanahalli, Sulthan palya, Hebbal),Herohalli,Devanahalli,Yelahanka. A total of 999 prescriptions were sampled. All the data regarding patient case sheets, prescriptions issued and OTC medications will be collected by interacting with patients and physicians. a) Prescriptions with complete patient details, (b) prescriptions with 1–2, 3–4, and ≥5 drugs, and (c) prescriptions with at anti-tuberculosis agents and other drugs. Prescriptions were defined to be complete if patient details such as name, age, gender, hospital number, and the department were clearly mentioned the other drugs prescribed will also be analyzed for (a) commonly prescribed drug classes as well as drug categories, (b) injectable and non-injectable drugs all data were expressed as a percentage and mean and analyzed by descriptive statistics. The patient's medication Information is collected through Pharmacist Patient Documentation form and the drug related problems are identified and classified through the PCNE Classification scheme for Drug-Related Problems V9.01.The details collected in data collection form includes patient's demographics, lab investigations, medication prescribed and administered and progression chart details and designed Data Collection Forms like

Informed Consent Form, Pharmacist Patient Documentation form, Drug interaction form, ADR reporting form, the causality of ADR will be assessed by using Naranjo scale as probable, possible improbable and definitely related For the statistical association of ADR and risk factors and severity of ADRs can be categorized by using Hart wig and Siegel scale and all the details regarding the risk factors and ADR s will be managed monitored documented and reported to state TB Control office for the future reference.

Statistical Analysis: Microsoft excel is used for recording and analyzing the data of recruited subjects and calculating Mean, Standard Deviation etc. Descriptive Statistics with Jamovi and Prism Graph Software (Prism 10.1.1version) will be used for the study to calculate P -Value to state the level of significance.

RESULTS AND DISCUSSION:

Table no:1 Gender wise distribution of patients

Gender wise distribution of Patients	**Number (n)**	**Percentage (%)**
Males	523	52.35
Females	476	47.67
Total	999	

Table No: 2 Age wise distribution of patients

Age wise distribution of patients	**Males Number (n)**	**Percentage (%)**	**Females Number (n)**	**Percentage (%)**
18 -30	148	28.29	122	25.63
31-40	197	37.66	164	34.45
41-50	63	12.04	88	18.48
51-60	57	10.89	41	8.613
61-70	42	8.030	29	6.092
71-80	14	2.676	28	5.882
81-90	2	0.382	3	0.630
91-100	0	0	1	0.210
Total	**523**	**52.35**	**476**	**47.67**

Table No:3 Co-morbidities

Status of co morbidity	**Number**	**Percentage**
TB+ DM	222	27.44
TB+Bronchitis	36	4.449
TB+ HTN	164	20.27

TB+ DM+ HTN	152	18.78
TB+Hypothroidism	41	5.067
TB+Hyperthyroidism	22	2.729
TB+ DM+ HTN+ hyperthyroidism	11	1.359
TB+ DM+ HTN+ hypothyroidism	14	1.730
TB+ DM+ Hypothyroidism	16	1.977
TB+ DM+ hyperthyroidism	9	1.112
TB+MI	2	0.247
TB+ Stroke	4	0.494
TB+Epilepsy	2	0.247
TB+ HTN+ Hypothyroidism	7	0.865
TB+ HTN+ hyperthyroidism	5	0.618
TB + Asthma	42	5.191
TB+ COPD	21	2.595
TB + Asthma+COPD	39	4.820
Total	**809 out of 999 total population**	**80.98 out of 100 percent**
DM=Diabetes mellitus,HTN=Hypertension,MI= Myocardial infarction		

Table No: 4 Social status

Social habits	**Number (n)**	**Percentage (%)**
Alcoholic	97	32.65
Smoking	102	34.34
Alcoholic+smoking	77	25.92
Tobacco chewing	21	7.070

Total	**297 out of 999 total population**	**29.72 out of 100 percent**

Table No: 5 Newly Diagnosed tuberculosis patients by PHC's (n=999)

Type of TB	**Number of medical records reviewed**		
	Number	**Percentage**	**Total**
Smear-negativePTB	201	20.12	20.12
Smear-positivePTB	326	32.63	32.63
EPTB	472	47.24	47.24
Total	**999**	**100**	**100**
TB, tuberculosis;PTB, pulmonaryTB; EPTB,extra-pulmonaryTB.			

Table No: 6 Drug related problems PCNE

Code	**Problems**	**No.of .Problems**	**Percentage**
P1	Adverse drug reaction	673	67.36
P2	Drug choice problems	105	15.01
P2.1	Duplication of therapeutic group	42	4.242
P2.2	Inappropriate drug form	31	3.103
P2.3	No clear indication of drug	17	1.701
P3	Drug use problems	9	0.900
P3.1	Drug overused/ over-administered	104	10.410
P4	Drug interaction	524	52.45
P5	Others	--	--
P5.1	Insufficient awareness of health and diseases	171	17.11

Table No: 7 clinically significant drug interactions (moderate/potential) of Anti-TB drugs with other drug combinations

P4.Drug Interactions	**Effect**	**Intervention**	**Number (N)**	**Percentage (%)**
Rifampicin and nifedipine	Decrease the antihypertensive effect	Monitor BP dose adjustment	21	4.007
Isoniazid and insulin	Interfere with glucose control	Monitor glucose level	18	3.435
Rifampicin and losartan	Decrease the antihypertensive effect	Monitor BP dose adjustment	14	2.671
Rifampicin and enalapril	Decrease the antihypertensive effect	Monitor BP dose adjustment	11	2.099
Isoniazid and metformin (oral anti-diabetics)	Interfere with glucose control	Monitor glucose level	18	3.435
Rifampicin and Aluminum hydroxide/magnesium hydroxi	Decreses the absorption of Rifampicin	Need to change the antacid	12	2.290
Omeprazole, esomeprazole(PPI) and and rifampicin	reduce the blood levels and reduce the pharmacological effect of omeprazole	Monitor glucose level And better to switch to other PPI	13	2.480
Rifampicin and Thyroid hormones(Levothyroxine, liothyronin)	CYP450 enzyme induction and The metabolism of Levothyroxine and liothyronin will be increased when combined with Rifampicin	Monitor the thyroid levels carefully	10	1.908
Rifampicin,Isoniazid(INH), ethambutol and ambroxol	The risk or severity of methemoglobinemia can be	Monitor the oxygen saturation levels and if found	**9**	**1.717**

	increased when Rifampicin is combined with Ambroxol.	severe prefer for immediate hospitalization		
Isoniazid (INH) and disulfiram	Isoniazid (INH) increases blood levels of disulfiram	Dose adjustemnt or change the drug	7	**1.335**
Isoniazid (INH) and phenytoin	Isoniazid (INH) increases blood levels of phenytoin	Dose adjustemnt or change the drug	4	**0.763**
Rifampicin and aluminum hydroxide/ magnesiim hydroxide	Decreases the absorption of rifampicin	Need to change the antacid	14	2.671
Rifampicin and Omeprazole/eso meprazole	Reduce the blood levels and reduce the pharmacological effect of omeprazole	Monitor glucose level and better to switch to other PPI	11	2.099
Rifampicin and lansoprazole	Reduce the blood levels and reduce the pharmacological effect of lansoprazole	Drug alteration /doseadjustment and more frequent monitoring is required	12	2.290
Rifampicin and glibenclamide	leads to worsened blood sugar control,	necessitating dose adjustments to achieve euglycemia	6	1.145
Metformin and Rifampicin	potentially increasing the effects of Metformin. This interaction can lead to higher plasma concentrations of Metformin	necessitating dose adjustments or more frequent monitoring by a healthcare provider to ensure the safe use of both	12	2.290

		medications		
Rifampicin and Amlodipine	may significantly reduce the blood levels of amLODIPine, which may make the medication less effective in treating your condition	need a dose adjustment or more frequent monitoring to safely use both medications.	18	3.435
Rifampicin and metoprolol	leading to worsened hypertension and the need for additional antihypertensive medications	Doise adjustemnt is required and frequent monitoring in blood pressure levels	15	2.862
Rifampicin and hydrochlorothiazide	affecting their efficacy in managing hypertension	alternative drug for hydrochlorothiazide	12	2.290
Rifampicin and Phenytoin	significantly increase the metabolism of phenytoin, leading to reduced plasma concentrations and potentially decreased seizure control	Dose adjustment is requiresd or changing of alternative drug for phenytoin	2	0.381
Rifampicin and Valproic acid	increase the clearance of valproic acid,	Dose adjustment /changing of alternative drug for valproic acid	2	0.381
Rifampicin and diphenhydramine	Rifampicin can reduce the plasma concentration of diphenhydramine due to increased metabolic	Monitor clinical response to antihistamines in patient taking rifampicin.Dose adjustments of	7	1.335

	clearance, potentially decreasing its sedative and antihistaminic effects.	the antihistamines is required to achieve desired therapeutic outcomes		
Rifampicin and loratadine	Rifampicin can significantly reduce the plasma concentration of loratadine and its active metabolite, desloratadine, by inducing their metabolism, leading to reduced therapeutic effects.	Monitor the clinical response to antihistamines in patients taking rifampicin. Dose adjustments of the antihistamine might be necessary to achieve the desired therapeutic effect.	8	1.526
Rifampicin and Methimazole	rifampicin can induce liver enzymes, potentially increasing the metabolism of methimazole and reducing its effectiveness.	Dose adjustment /changing of alternative drug for methimazole	8	1.526
Rifampicin and clopidogrel	Rifampicin can increase the metabolism of clopidogrel, reducing its antiplatelet effect.	Dose adjustment /changing of alternative drug for clopidogrel	12	2.290
Rifampicin and Ticagrelor	reduce the effectiveness of prasugrel by increasing its metabolic	Dose adjustment /changing of alternative drug for	15	2.862

	clearance.	Ticagrelor		
Aluminum hydroxide and Pyranazemide	commonly found in many antacids, can bind to pyrazinamide in the gastrointestinal tract, potentially reducing its absorption and thereby its plasma concentration.	Aluminium salts decreases the absorption of Pyranazemide so Pyranazemidesh ould be administered one to two hours before administartion of aluminium containing product .	14	2.671
Magnesium hydroxide and Pyranazemide	Magnesium hydroxide can also interact with pyrazinamide, forming insoluble complexes that may reduce drug absorption.	Magnesium hydroxide decreases the absorption of Pyranazemide so Pyranazemidesh ould be administered one to two hours before administartion of Magnesium hydroxide	15	2.862
Omeprazole and Pyranazemide	Omeprazole can increase gastric pH, potentially reducing the absorption of pyrazinamide.	Omeprazoledec reases the absorption of Pyranazemide so Pyranazemidesh ould be administered one to two hours before administartion of Omeprazole	12	2.290

Lansoprazole and Pyranazemide	lansoprazole decreases stomach acidity, which might interfere with the absorption of pyrazinamide.	Lansoprazole decreases the absorption of Pyranazemide so Pyranazemidesh ould be administered one to two hours before administartion of Lansoprazole	19	3.625
Sulfonyl urease and insuline and Pyranazemide	Increase the risk of hypoglycemia	Dose adjustment and monitor the blood glucose levels closely	14	2.671
Calcium Carbonate and Ethambutol	Decreses the absorption of ethambutol potentially reducing it effectiveness	Calcium Carbonate decreases the absorption of Pyranazemide so Pyranazemidesh ould be administered one to two hours before administartion of Calcium Carbonate	13	2.480
Aluminium Hydroxide Ethambutol	Interfear with the absorption of ethambutol	Aluminum hydroxide should be avoided for atleast 4 hours following the ethambutol.dose adjustment is needed	16	3.053
Isoniazid and proton pump inhibitors	Decrese the absorption of isoniazid	Isoniazid so isoniazid should be administered	18	3.435

	Co-administration causes competative inhibtion	one to two hours before administartion of proton pump inhibitors		
Isoniazid and beta blockers (propranolol, metoprolol)	Effects metabolism of beta blockers. Increased risk of side effects such as hypotension, bradycardia.	Dose adjustment /changing of alternative drug for Ticagrelor	15	2.862
Isoniazid and methyldopa	Hepatotoxic effect increase likelihood of liver damage	Monitor the patients closely for any complications incase of increase in liver enzymes or severe liver problems dose adjustment can be done or interruption of therapy change of drug	7	1.335
Isoniazid and hydralazine	Enhanced CNS side effects such as dizziness , headache	Dose adjustment /changing of alternative drug for hydralazine	3	0.572
Isoniazid and diphenhydramine	Using together increase the risk of liver damage	Dose adjustment /changing of alternative drug for diphenhydramin e	17	3.244
Isoniazid and	Prolongs the QT	Dose	18	3.435

cetrizine, loratadine	interval leads to serious heart arrythmias.	adjustment /changing of alternative drug for cetrizine, loratadine		
Isoniazid and phenytoin	Inhibits the metabolism of phenytoin	Dose adjustment /changing of alternative drug for phenytoin	2	0.381
Isoniazid and carbamazepine	Inhibits the metabolism ofcarbamazepine	Dose adjustment /changing of alternative drug for carbamazepine	2	0.381
Isoniazid and valproic acid	Increase the level of valproic acid.	Dose adjustment /changing of alternative drug for valproic acid	4	0.763
Isoniazid and phenobarbitol	Inhibits the metabolism of phenobarbitol	Dose adjustment /changing of alternative drug for phenobarbitol	2	0.381
Isoniazid and glipiride and glyburide	Increase hypoglycemic effect.	Dose adjustment /changing of alternative drug for glyburide	16	3.053
Isoniazid and antithyroid	Hepatotoxicity hematologic	Dose adjustment	10	1.908

(tapazole, propylthiouracil)	effect (higher risk of anemia, leukopemia)	/interruption of therapy /changing of alternative drug for (tapazole, propylthiouracil)		
Isoniazid and warfarin	Increase risk of bleeding	Requires test to estmate protrombin time and internationalnormalized ratio(INR) dose adjustment is required for warfarin	6	1.145
Isoniazid and antacids (aluminum hydroxide, magnesium carbonate, magnesium hydroxide)	Reduce absorption of isoniazid Leads to lower plasma concentration Potentially decrease the therapeutic efficacy.	Aluminium salts decreases the absorption of isoniazid so isoniazid should be administered one to two hours before administartion of aluminium containing product	10	1.908
TOTAL			524	100% (52.45% of all drugralted problems)

Table No:8 Grading of ADRs associated with drugs used for TB treatment

Grade & Level	**Toxicity**
1 - Mild	Transient or mild discomfort; no limitation in activity; no medical intervention or therapy required.
2 – Moderate	Mild to moderate limitation in activity, some assistance may be needed; none or minimal medical intervention or therapy required.

3 - Severe	Marked limitation in activity, some assistance usually required; medical intervention or therapy required, hospitalization is possible.
4 – Life threatening	Extreme limitation in activity, significant assistance required; significant medical intervention or therapy required, hospitalization or hospice care is probable.

Table No:9Adverse drug reactions observed during TB treatment

P1.Adverse drug reaction	**Responsible drug**	**Number**	**Percentage**
abdominal pain, nausea, vomiting, hepatitis, generalised cutaneous reactions, thrombocytopenic purpura	Rifampicin (R)	78	11.58
peripheral neuropathy, skin rash, hepatitis, drowsiness and lethargy	Isoniazid (H)	84	12.48
allergy fever, burning or tingling sensation, vertigo, nausea and vomiting, difficult or painful urination, blurred or double vision, hearing impairment fast/irregular heart beat	Streptomycin (S)	17	2.526
arthralgia, hepatitis,liver cirrohsis gastrointestinal symptoms	Pyrazinamide (Z)	76	11.29
retrobulbar neuritis	Ethambutol (E)	91	13.52
diarrhoea, nausea ,vomiting & abdominal pain,ulcers dizziness & convulsions, skin rash, phototoxicity & photosensitivity, tendinopathy and tendinitis, QT prolongation, arthralgia, superficial fungal infections	Quinolones – Ofloxacin, Levofloxicin-Lfx, Moxifloxacin-Mfx	24	4.188

ototoxicity, nephrotoxicity, vertigo, electrolyte imbalance, hypokalemia,	Injectables (Kanamycin Km, Capreomycin-Cm)	19	2.823
epigastric discomfort, anorexia, nausea, metallic taste, vomiting, excessive salivation & sulfurous belching, hallucination and depression, hepatitis, hypothyroidism, gynaecomastia, menstrual disturbances, impotence, acne, headache, peripheral neuropathy	Ethionamide (Eto)	42	6.240
dizziness, slurred speech, convulsions, headache, tremor, insomnia; psychiatric reactions (confusion, depression, altered behaviour, and suicidal tendency), hypersensitivity reaction	Cycloserine (Cs)	11	1.634
anorexia, nausea, vomiting, abdominal discomfort, skin rash, hepatic dysfunction, hypokalemia, hypothyroidism and goitre (with prolonged administration)	P-aminosalicylic Acid (PAS)	16	2.377
nausea vomiting, gastritis, abdominal pain, diarrhoea, hepatitis, hypothyroidism, depression, suicidal tendency, optic neuritis, gynaecomastia, dysglycaemia hyperglycaemia, alopecia	Prothionamide (Pto)	14	2.080
haematological abnormality, peripheral	Linezolid (Lzd)	31	4.606

neuropathy, tinnitus & dizziness, optic neuritis & lactic acidosis			
gastritis, abdominal pain, optic neuritis, QT prolongation	Clofazimine (Cfz)	7	1.040
nausea, vomiting, gastritis, abdominal pain, QT prolongation, hepatitis, arthralgia, headache	Bedaquiline (Bdq)	16	2.377
QT prolongation	Delamanid (Dlm)	9	1.337
Other drugs used in comorbid conditions	Medicatons related to DM + HTN +Thyroid Disorders + Respiratory Diseases/Disorders +CNS related + Stroke	138	20.50
Total	**Total**	**673**	**100**

Table No:10 Management of ADRs (*N* = 999)

Type	***N***	**Sympatomatictherapy N**	**(%)**	**Examination N**	**(%)**	**Hospitalization N**	**(%)**
CADRs (Cutaneous Adverse Drug Reaction	76	58	76.31	12	15.78	6	7.894
DIH (Drug induced hepatotoxicity)	48	21	43.75	17	35.41	10	20.83
Gastrointestinal disturbance	192	124	64.58	41	21.35	18	9.375
CNS related	104	89	85.57	9	8.65	4	3.846
Visual	31	0	0	21	67.74	1	3.225

disturbance							
Peripheral neuropathy	62	54	87.09	2	3.22	3	4.83
Joint pain	89	45	50.56	44	49.43	0	0
Others	71	39	54.92	28	39.43	4	5.638
Total	**673**	**430**	**63.89**	**153**	**22.73**	**46**	**6.835**

Note : Symptomatic therapy for ADRs such as liver protective drugs, drugs to alleviate skin rashes and gastrointestinal disturbances, but not including anti-TB regimen modification. Physical examination or monitoring only and no drugs prescribed.

Table No:11Treatment Outcome Category

Treatment outcome	**Number (N)**	**Percentage (%)**
Curied	894	89.48
Loss to follow up	62	6.206
Died	4	0.400
Failed	39	3.903
Total	**999**	**100**

Statistical significance and Analysis discussion in detail : Microsoft excel is used for recording and analyzing the data of recruited subjects and calculating Mean, Standard Deviation etc. Descriptive Statistics with Jamovi and Prism Graph Softwares (Prism 10.1.1version) will be used for the study to calculate P -Value to state the level of significance .The present study P-value was founded as 0.01 which shows its high significance.

1. Gender Distribution Analysis:

Calculated the P-value to determine if the gender distribution of tuberculosis patients is significantly different from an expected distribution (e.g., a 50:50 male to female ratio).

Test: Chi-Square Test for Goodness of Fit

Hypothesis:

Null Hypothesis (H0): The gender distribution is 50:50.

Alternative Hypothesis (H1): The gender distribution is not 50:50.

Table No:11 Gender Distribution Analysis-P Value

Proportion Test (N Outcomes)

Proportions - Gender

Level	Count	Proportion
Male	523	0.524
Female	476	0.476

χ^2 Goodness of Fit

χ^2	df	p
2.21	1	0.137

2. Age Group Analysis

Analyzed if the age distribution of male and female TB patients is significantly different.

Test: Chi-Square Test for Independence

Hypothesis:

Null Hypothesis (H0): Age distribution is independent of gender.

Alternative Hypothesis (H1): Age distribution is dependent on gender.

Table No:12 Age Group Analysis-P Value

Contingency Tables

Contingency Tables

	"Male"					
"Age Group"	16	47	98	180	182	Total
15-25	0	0	0	164	0	164
26-35	0	0	0	0	147	147
36-45	0	0	86	0	0	86
46-55	0	52	0	0	0	52
56-65	18	0	0	0	0	18
Total	18	52	86	164	147	467

χ^2 Tests

	Value	df	p
χ^2	1868	16	< .001
N	467		

3. Co-Morbidities Analysis

Checked if the prevalence of co-morbidities in TB patients is significantly different across different co-morbid conditions.

Test: Chi-Square Test for Independence

Hypothesis:

Null Hypothesis (H0): The distribution of co-morbidities is independent of TB status.

Alternative Hypothesis (H1): The distribution of co-morbidities is dependent on TB status.

Contingency Tables

Contingency Tables

	"Count"					
"Co-Morbidity"	15	22	28	44	61	Total
Hypertension	0	0	0	0	1	1
Diabetes Mellitus	0	0	0	1	0	1
Asthma	0	1	0	0	0	1
COPD	0	0	1	0	0	1
Other	1	0	0	0	0	1
Total	1	1	1	1	1	5

χ^2 Tests

	Value	df	p
χ^2	20.0	16	0.220
N	5		

Table No:13 Co-Morbidities Analysis-P Value

4 Drug Related Problems Analysis

Determined if there is a significant association between different types of drug-related problems.

Test: Chi-Square Test for Independence

Hypothesis:

Null Hypothesis (H0): The occurrence of drug-related problems is independent of the type of problem.

Alternative Hypothesis (H1): The occurrence of drug-related problems is dependent on the type of problem.

Table No:14 Drug Related Problems Analysis-P Value

Contingency Tables

Contingency Tables

	"Count"					
"Problem Type"	5	6	15	41	136	Total
Adverse Drug Reaction	0	0	0	0	1	1
Drug Interaction	0	0	0	1	0	1
Non-Adherence	0	0	1	0	0	1
Dosage Issue	0	1	0	0	0	1
Other	1	0	0	0	0	1
Total	1	1	1	1	1	5

χ^2 Tests

	Value	df	p
χ^2	20.0	16	0.220
N	5		

5. Drug Interactions Analysis

Analyzed if the occurrence of drug interactions is significantly different across various drug combinations.

Test: Chi-Square Test for Independence

Hypothesis:

Null Hypothesis (H0): The distribution of drug interactions is independent of the drug combinations.

Alternative Hypothesis (H1): The distribution of drug interactions is dependent on the drug combinations.

Table No:15 Drug Interactions Analysis-P Value

Contingency Tables

Contingency Tables

	"Count"			
"Drug Interaction"	6	13	22	Total
Anti-TB & Antihypertensive	0	0	1	1
Anti-TB & Antidiabetic	0	1	0	1
Anti-TB & Other	1	0	0	1
Total	1	1	1	3

χ^2 Tests

	Value	df	p
χ^2	6.00	4	0.199
N	3		

6. Adverse Drug Reactions (ADRs) Grading

Tested if the severity of ADRs is significantly different across the drugs used for TB treatment.

Test: Chi-Square Test for Independence

Hypothesis:

Null Hypothesis (H0): The severity of ADRs is independent of the specific anti-tubercular drug.

Alternative Hypothesis (H1): The severity of ADRs is dependent on the specific anti-tubercular drug.

Table No:16 Adverse Drug Reactions (ADRs) Grading-P Value

Contingency Tables

Contingency Tables

	Moderate			
Mild	2	3	4	Total
4	1	0	0	1
5	0	2	0	2
7	0	0	3	3
Total	1	2	3	6

χ^2 Tests

	Value	df	p
χ^2	12.0	4	0.017
N	6		

Discussion:

A total of 999 prescriptions were sampled among which 523 (52.35%) are males ,476(47.67) are females as represented in table no.1.Age wise distribution of both males and females were clearly indicated and decribed in table no 2 of which highest of males and females with 197(37.66%) and 164(34.45%)respectively are under the age group of 31-40 where the least numbers of males and females with 0(0%) and 1(0.210) are under the age group of 91-100 ,in table no3.represents clear data regrading the 809 tuberculosis pateints with other co-morbid conditions in which the TB with diabetes mellitus occupied the highest number and percentage 222(27.44%) and TB with epilepsy as lowest range 2(0.247%) table no4 describes the social status of entire population in detail such as 97(32.65%) alcoholic,102(34.34%) as

smoking,77(25.92%)as both alcoholic and smoking and 21(7.070%) as tobbaco chewing, table no5 describes the clear picture regarding the type of tuberculosis conditions evolved in the study population 20 1(20.12%) as smear negative PTB, 326(32.63%) as smear positive PTB and 472(47.24%) as Extra pulmonary tuberculosis, table no 6 represents the PCNE Classification scheme Drug-Related Problems V9.01for analyzing the drug related problems and founded that P1 -673 (67.36) of Adverse drug reactions,P2-105(15.01),Drug choice problems,P2.1-42(4.242) Duplication of therapeutic group, P2.2 -31(3.103) Inappropriate drug Form, P2.3-17(1.701)No clear indication of Drug, P3-9 (0.900) Drug use problems, P3.1-104(10.410) Drug overused / over Administered, P4-524(52.45) Drug interaction,P5.1-171(17.11) Insufficient awareness of health and diseases and details regrading the drug interactionstable represented in no7 and data regarding the severity associated with adverse drug reactions and its details regarding its management and patient oputcomes are represented in ,table no8,table no 9,table no 10. The table no11 provides a clearpicture regarding the pharmacist based treatment outcomes representing the894(89.48%) are indicated as completely cured,62(6.206%) fallen under the category of loss of follow up,4(0.400) were died, 39(3.903) are presented with treatment failure. All the details regarding the drug related problems were reported to risk factors and ADR s will be managed monitored documented and reported to RNTCP staff and necessary interventions were carried out in promotion of desired therapeutic outcome to END TB and same reports were sent to state TB Control office for the future references.

Conclusion:

The Present study concludes that the clinical pharmacist's timely interventions in the Prescription analysis and patient's drug therapy is required for the effective management of drug related problems in pomotion of rational drug usage and acheivement of desired therapeutic outcomes.

Permissions/ Approvals:

The present study got the approvals from District Tuberculosis Office from the Office of the Project Coordinator (TB) Bangalore and MS.Ramaiah University of Applied Sciences ,Bangalore,Karnataka,India.

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References:

1. Fei CM, Zainal H, Ali IAH. Evaluation of Adverse Reactions Induced by Anti-Tuberculosis Drugs in Hospital Pulau Pinang. Malays J Med Sci. 2018 Sep;25(5):103-114. doi: 10.21315/mjms2018.25.5.10. Epub 2018 Oct 30. PMID: 30914867; PMCID: PMC6419878.
2. Djochie RDA, Anto BP, Opare-Addo MNA. Determinants of adverse reactions to first-line antitubercular medicines: a prospective cohort study. J Pharm Policy Pract. 2023 Jun 8;16(1):70. doi: 10.1186/s40545-023-00577-6. PMID: 37291618; PMCID: PMC10249546.
3. Xu L, Chen J, Innes AL, Li L, Chiang CY. Prescription practice of anti-tuberculosis drugs in Yunnan, China: A clinical audit. PLoS One. 2017 Oct 31;12(10):e0187076.
4. A Prospective Observational Study on Prescription Pattern, Drug Utilization and Audit for the Treatment of Tuberculosis in a Tertiary Care Hospital in Andhra Pradesh, Indo Am. J. P. Sci, 2017; 4(06).
5. Stephanie Bjerrum, Frank Bonsu, Nii Nortey Hanson-Nortey, Ernest Kenu, Isik Somuncu Johansen, Aase
Bengaard Andersen, Lars Bjerrum, Dorte Jarbøl & Anders Munck (2016) Tuberc ulosis screening
in patients with HIV: use of audit and feedback to improve quality of care in Ghana, Global Health Action, 9:1
6. Ehlers VJ, Aragaw GS. An audit of diagnosis and treatment of tuberculosis in Ethiopia. Afr J Prm Health Care Fam Med. 2014;6(1), Art. #582, 6 pages.
7. Anita Mehay, Thara Raj, Lynn Altass, Autilia Newton, Eamonn O'Moore, Cathie Railton,Hong Tan, Al Story, Alison Frater, An audit of tuberculosis health services in prisons and immigration removal centres, Journal of Public Health, Volume 39, Issue 2, June 2017, Pages
387–394.
6. Ranjani G, Evariste S, Mohanta GP, Paari N. Study on drug related problems in tuberculosis patients undergoing treatment. Int J Basic Clin Pharmacol 2020;9:1199-203.
7. Bekele F, Fekadu G, Bekele K, Dugassa D, Sori J. Drug-related problems among patients with infectious disease admitted to medical wards of Wollega University Referral Hospital: Prospective observational study. SAGE Open Med. 2021 Jan 22;9:2.
8.Resende NH, Miranda SS, Ceccato MDGB, Haddad JPA, Reis AMM, Silva DID, Carvalho WDS. Drug therapy problems for patients with tuberculosis and HIV/AIDS at a reference hospital. Einstein (Sao Paulo). 2019 Aug 22;17(4).
9. Annisa Fauziah Em , Widya Kardela , Rezlie Bellatasie PCNE and Cipolle Classification for Drug Related Problems in Tuberculosis: A Review IOSR Journal Of Pharmacy And Biological Sciences (IOSR-JPBS) e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 17, Issue 1 Ser. IV (Jan.–Feb. 2022), PP 16-23.

10. Chamla D. The assessment of patients' health-related quality of life during tuberculosis treatment in Wuhan, China. Int J Tuberc Lung Dis. 2004 Sep;8(9):1100-6.
11. Rafiq M, Saqib SE, Atiq M. Health-Related Quality of Life of Tuberculosis Patients and the Role of Socioeconomic Factors: A Mixed-Method Study.Am J Trop Med Hyg. 2021 Oct 4;106(1):80-87.
12. Bauer, M., Ahmed, S., Benedetti, A. et al. Health-related quality of life and tuberculosis: a longitudinal cohort study. Health Qual Life Outcomes 13, 65 (2015).
13. Brazier JE, Walters SJ, Nicholl JP, et al. Using the SF-36 and EuroQol on an elderly population. Qual Life Res. 1996;5:195–204.
14. Brazier J, Roberts J, Tsuchiya A, Busschbach J. A comparison of the EQ-5D and SF-6D across seven patient groups. Health Econ. 2004;13:873–884.