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Research Article

**ROLE OF A CLINICAL PHARMACIST IN THE MANAGEMENT OF  
HYPERTENSION AND DIABETES MELLITUS: THE TWIN DISEASE**Swarna Priya B<sup>1</sup>, K. Tharun<sup>2\*</sup>, Divyansh Dixit<sup>3</sup>

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**Abstract:**

**Background:** Hypertension and diabetes are paramount diseases in the lifestyle disease catalog. Even with specific treatments available, the prevalence of diabetes with hypertension has got special attention. Regarding the various complications of this twin disease, the required therapeutic outcome, along with non-compliance and improved quality of life, can be attained by clinical pharmacy services. The current study aimed to investigate the evidence to summarize the role of clinical pharmacists to flatten the curve.

**Main body:** The functional triage role of clinical pharmacists includes providing pharmaceutical care, enhancing medication management, and ADR monitoring. Pharmaceutical care services include analyzing drug-related problems regarding cost-effectiveness, better outcome, safety, and efficacy. Medication management includes strategies for the selection of drugs, applicable drugs, ADR monitoring, and assessing drug-drug interactions, drug-food interactions to accomplish safe, efficient, and cost-effective therapy. Also, an essential resource of patient counseling can gradually decrease the risk of medicine mismanagement, non-compliance, and non-adherence. The advantage is also added in the case of prescribing by implementing rational drug use and addressing ADR, interactions, and patient counseling information.

**Conclusion:** However, all available studies reported some positive impact resulting from clinical pharmacist involvement, and evaluating that outcome is improved. Targeting multiple risk factors is crucial in preventing and slowing the progression of these complications. Appropriate education and awareness among the patient and caregivers can result in stunning outcomes. In contrast, only clinical pharmacists from the health care team can keep the track in productive ways and bridge the gap between the patients and the health care team.

**Keywords:** Clinical pharmacist, Clinical pharmacy services, Diabetes Mellitus, Hypertension, Lifestyle disease, Outcomes, Twin disease.

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**INTRODUCTION:**

Lifestyle diseases have been a global threat since the 1990s. These are a category of disorders that are linked with a person's way of life. These are commonly caused by a lack of physical activity, smoking, alcohol consumption, etc. Hypertension and diabetes are

paramount diseases in the catalog. Hypertension is a widely observed comorbidity of diabetes that affects around 20- 60% of diabetes patients. The American College of Cardiology/American Heart Association (ADA/ AHA) Task Force, 2017 classifies blood pressure as described in the table 1 [1].

**TABLE 1 THE STAGES OF HYPERTENSION IN REGARD TO SYSTOLIC AND DIASTOLIC BLOOD PRESSURE AS PER AMERICAN HEART ASSOCIATION (AHA).**

BLOOD PRESSURE CATEGORY	SYSTOLIC (mm Hg)		DIASTOLIC (mm Hg)
NORMAL	<120	And	<80
ELEVATED	120-129	And	<80
STAGE 1 HTN	130-139	Or	80-89
STAGE 2 HTN	≥140	Or	≥90
HYPERTENSIVE CRISIS	>180	And/or	>120

Diabetes mellitus commonly called hyperglycemia is characterized by high blood glucose levels and is one of the most common evolving diseases in the current era. Even with specific treatments available, the prevalence of diabetes has got special attention. More than 1 in 4 people of diabetes population are over the age 65 [2]. Although, diabetes has comorbidities with renal, nerve and ophthalmological diseases, heart diseases have got particular surveillance in the health sector. In this regard, hypertension and diabetes are called twin diseases. These two diseases occur alongside; having hypertension appears to increase the risk of diabetes and vice versa. As these diseases share slightly common symptoms and complications, it is necessary to treat and manage to avoid secondary infections emerging from these. The prevalence of hypertension in diabetic individuals is noted to be 1.5-3 times higher compared to the nondiabetic age-matched population. Extensive epidemiological data reveals that diabetic individuals with hypertension are at a higher risk of cardiovascular disease, renal insufficiency and diabetic retinopathy. Hypertension is common in newly diagnosed diabetes patients. A study shows that about 40% of patients had Hypertension at the time of diabetes diagnosis. When nephropathy is present, extracellular fluid volume and total body sodium levels are found to be increased. The activity of the renin-angiotensin-aldosterone system (RAAS) is lowered in such patients, and hypertension is volume dependent, as seen in other nephropathies. While, in the absence of diabetic nephropathy, other factors are responsible for the development of hypertension. These include or regular activity of the RAAS has been noted. Studies in hypertensive patients have observed hyperinsulinemia secondary to insulin resistance and reduced insulin clearance. About 75% of DM patients develop HTN with diverse mechanisms. Patients with diabetes mellitus carry a

risk of cardiovascular death similar to that of patients with a previous myocardial infarction [3]. Clinical pharmacy services can attain the required therapeutic outcome along with non-compliance and improved quality of life. Clinical pharmacy services can bridge the gap between patients and the health care team. This framework includes pharmaceutical care, medication management, and ADR monitoring. Pharmaceutical care is a patient-centered activity involving drug-related problems, and medication management consist of a better selection of the drug, monitoring the therapy, reporting Adverse Drug Reactions drug interaction, and patient counselling. These clinical pharmacy services ensure safety, efficacy, and cost-effective treatment with prospective outcomes. They are the findings include improved quality of life, non-compliance, complete patient response, and better therapeutic outcome. Pharmaceutical care addresses four points - societal need, patient-centered approach, patient care, and optimal therapy. The other requirements are developing a therapeutic relationship with the patients, understanding the responsibilities of the practitioner (patient care process) and needs of the patient; applying a systematic and rational process (pharmacotherapy workshop), appropriate knowledge on clinical skills, practice standards and follow ethics, and documentation (SOAP and FARM techniques). Drug therapy monitoring helps the pharmacist in monitoring the dose of the drug, duration of the therapy, and drug-related problems/medicine-related problems. These drug-related problems include ADR reporting, drug interactions, and treatment failure. This aspect of TDM is used to measure the presence of toxicity of the drug, assessing the factor that alters the pharmacokinetics, dose changes, and medication adherence. The objective of clinical pharmacy services is aimed at patients (patient needs, patient ability, and patient health). Thus by the above compound ways,

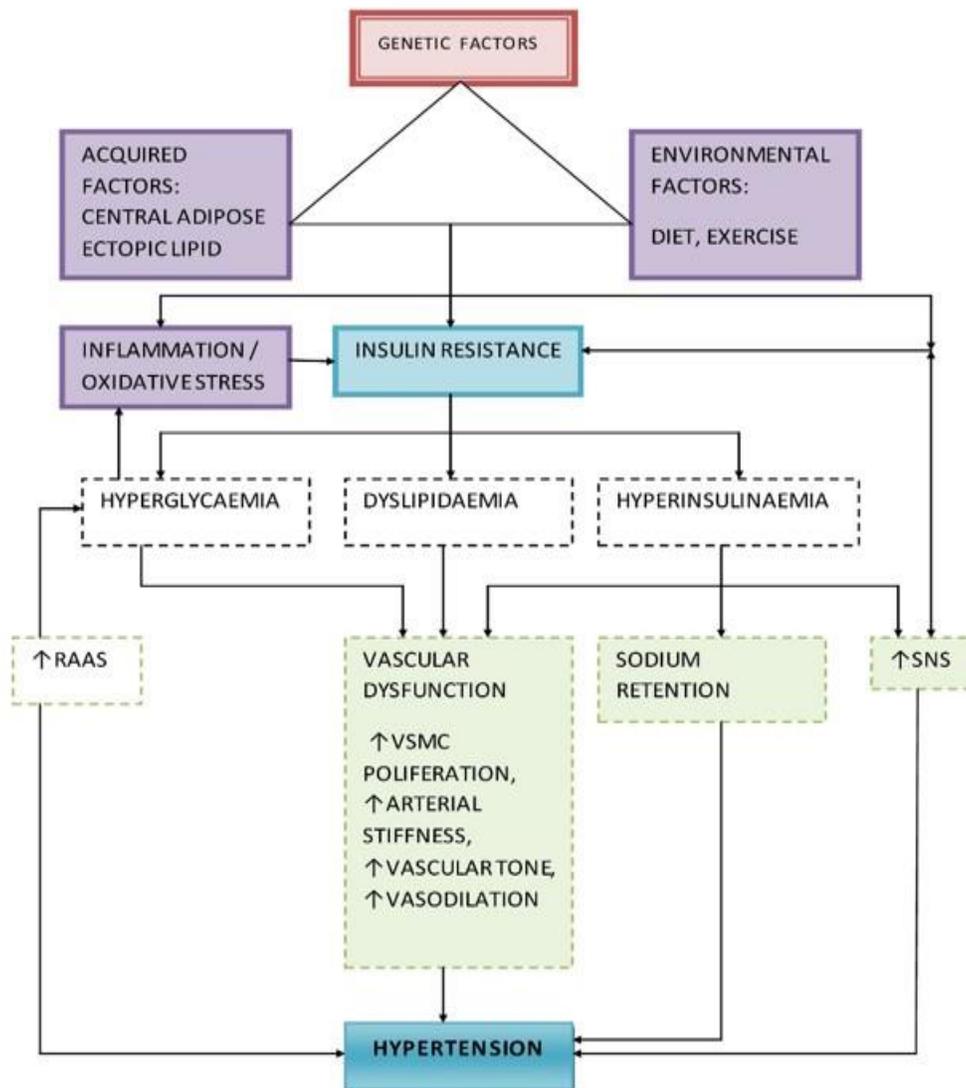
drug-related problems can be reduced. The current study aimed to investigate the evidence to summarize the role of clinical pharmacist to flatten the curve.

### PATHOPHYSIOLOGY:

Type 2 diabetes is characterized by insulin resistance and  $\beta$ -cell dysfunction, and hypertension is characterized by increased peripheral vascular

resistance and endothelial dysfunction[4]. These pathophysiological paths are interlinked in several ways like they share common pathways such as the sympathetic nervous system (SNS), renin-angiotensin-aldosterone system (RAAS) 1 oxidative stress, adipokines, insulin resistance, and Peroxisome proliferator-activated receptor pars[5].

**FIGURE 1: Summary of recognized pathophysiologic mechanism in the development of hypertension in diabetes mellitus**



**COMPLICATIONS:**

Hypertension is also known to be an essential risk factor for the development of cardiovascular events, e.g., myocardial infarction and stroke; it also acts as a significant risk factor for microvascular complications like retinopathy and nephropathy. Cardiovascular disease, the costliest complication of diabetes, is responsible for an 86% mortality rate in the diabetic population[6]. Elevated blood pressure is known to contribute to diabetic microvascular and macrovascular complications, and reductions in blood pressure can decrease the risk of these complications.3 these complications are shown in Table 2[7]. Hypertension and diabetes are 2 of the leading risk factors for atherosclerosis and its complications, including heart attacks and strokes. Patients with type 2 Hypertension and diabetes are 2 of the leading risk factors for atherosclerosis and its diabetes, sex (male), family history, age, complications Duration of diabetes adds to risk, and body mass index (BMI) continue to whereas proper renal function is protective[8].

**PREVENTION:**

It is recommended that all patients with diabetes should undergo routine blood pressure measurements at each scheduled diabetes follow-up visit. Diabetic individuals with blood pressures above 130 mmHg systolic or above 80 mmHg diastolic are considered to be the candidates for antihypertensive treatment that aims to lower the blood pressure to < 130/80 mmHg.

**RISK ASSESSMENT:**

Urinalysis to detect microalbuminuria Resting electrocardiogram (ECG) Ankle-brachial Index The carotid Examples intima-media thickness Exercise ECG (for assessment of exercise capacity) Resting echocardiography (to detect left ventricular hypertrophy), Coronary artery calcium (CAC) scan (in those >40 years of age or low intermediate-risk patients) Stress myocardial perfusion imaging (in those at high risk of CHD, such as CAC score >400) Targeting multiple risk factors is essential for preventing and slowing the progression of macrovascular and microvascular complications

**Table 2: MICROVASCULAR AND MACROVASCULAR COMPLICATIONS OF HYPERTENSION AND DIABETES MELLITUS**

<b>MICROVASCULAR COMPLICATIONS</b>	<b>MACROVASCULAR COMPLICATIONS</b>
Renal diseases	Cardiac diseases - CAD, CHF, and cardiomyopathy
Autonomic neuropathy, sexual dysfunction, and orthostatic hypertension	Cerebrovascular disease - stroke
Ophthalmic disease - glaucoma and diabetic retinopathy with potential blindness	Peripheral vascular disease- hypertension increases the risk of peripheral vascular disease and subsequent foot ulcers and amputations in patients with diabetes

**Table 3: INTERVENTIONAL GOALS TO REDUCE THE INCIDENCE OF MICROVASCULAR COMPLICATIONS**

COMPLICATION	METHODS	FREQUENCY	OPTIMAL GOALS
Nephropathy	Urine microalbumin	Annually	Albumin <30mg/24hr or Albumin-Creatinine ratio <30mg/ g in random urine specimen
	GFR estimation by serum creatinine	Annually	GFR > 90 mL/min/ 1.72m <sup>2</sup>
Retinopathy	Dilated and comprehensive eye exam	Initially type 1: 3-5 years after onset Type 2: From diagnosis annually, more frequently if pregnant or progressive retinopathy.	Primary prevention, delay of progression, and prevention of blindness from retinopathy.
Neuropathy	Daily self-inspection of feet Comprehensive foot examination Examination of distal symmetric polyneuropathy  Assessment of autonomic neuropathy	Every visit Annually At diagnosis and Annually Type 1: 5 years after diagnosis Class 2: from diagnosis	Intact skin Normal examination Early detection and limb preservation  Early detection, symptom control, recognition of associated cardiovascular risk

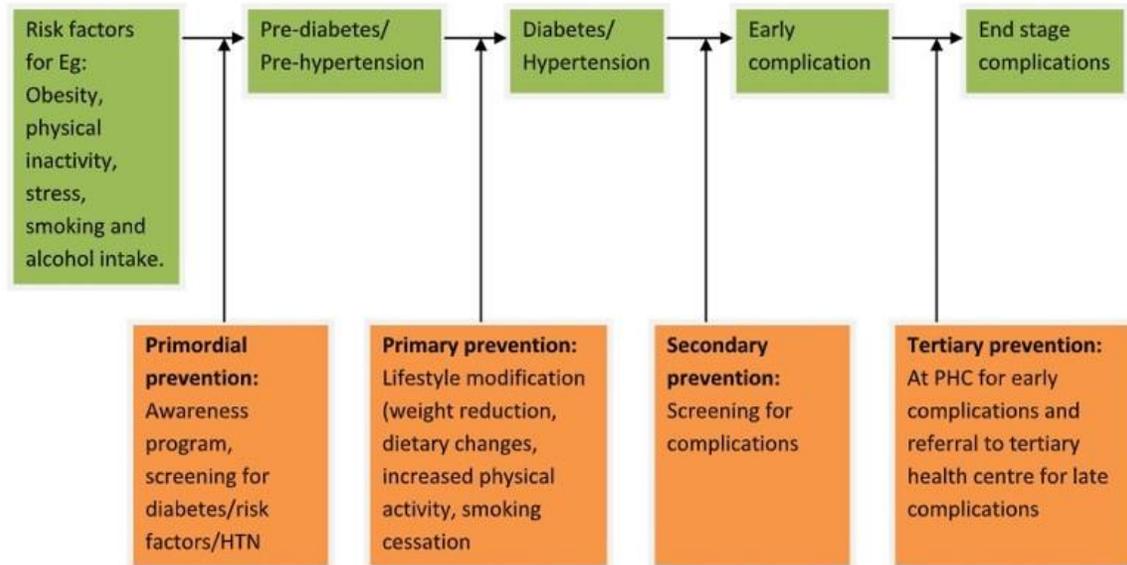
**Table 4: INTERVENTION GOALS TO REDUCE THE INCIDENCE OF MACROVASCULAR COMPLICATIONS.**

RISK FACTOR	GOAL
Smoking	Cessation, using counseling or medications
Obesity	Weight Reduction by exercise: 30 _ 60 · f. minutes of moderate-intensity aerobic exercise at least three times per week Diet: Fat of <30% total calories with <7% saturated fat and < 1% trans-fat; sodium restriction
Hypertension	Blood Pressure of < 130/80mmHg
Dyslipidemia	TG < 150 mg/ dL High Risk Patients: LDL <70mg/ dL; Non-HDL < 100mg/ dL; Apo B <80mg/ dL Non-High-Risk Patients: LDL < 100mg/ dL; Non-HDL < 130mg/ dL; Apo B <90mg/ dL
Hyperglycemia	HbA1C <7%
Dys Fibrinolysis	Aspirin primary prevention in high-risk patients· Secondary prevention in patients with cardiovascular disease
Inflammation	High-sensitivity C-reactive protein <2mg/L

As hypertension and diabetes mellitus share many common risk factors, an integrated approach to the prevention and control of both is reasonable and tackling both problems at several levels; that is, primordial, primary, secondary, and tertiary prevention is essential[9].

- Primordial prevention: Reduction of the risk factors of diabetes mellitus/ hypertension and thereby decreasing the risk of developing diabetes mellitus in the future.

- Primary Prevention: Prevention (or postponement) of the condition in those in a prediabetes/hypertension stage.
- Secondary Prevention: Prevention of complications in those who have already developed diabetes mellitus / hypertension.
- Tertiary Prevention: limitation of physical disability and preventing progression to feed stage complications in those who have already developed some associated complications.

**Figure 2: Classification of risk factors and prevention at various levels for hypertension and diabetes.****INTERCONNECTION - HTN AND DM:**

Globally, diabetes mellitus (DM) and hypertension (HTN) have emerged as critical medical as well as public health issues carrying essential risk factors for coronary artery disease (CAD), heart failure, renal impairment, and cerebrovascular disease. In the real practice setting, the occurrence of diabetes and hypertension is observed in the same individual more often, whereas the overlap between dysglycemia and raised blood pressure is even more substantial than that between diabetes and hypertension, such as over one-half of people (58%) with diabetes have elevated blood pressure, and over one-half of people (56%) with hypertension have dysglycemia. Up to 75% of adults with diabetes also have hypertension, and patients with hypertension alone often show evidence of insulin resistance[10]. Hyperglycemia and total body exchangeable sodium elevation lead to renal insufficient fluid accumulation and expansion of the plasma volume. In some individuals, alterations in the function of the renin-angiotensin- aldosterone system and vascular sensitivity to vasoactive hormones are believed to play an important role. According to recent evidence, hyperinsulinemia and insulin resistance may also contribute to the maintenance of high blood pressure, as insulin is known to promote sodium retention and enhance sympathetic nervous system activity[11]. An observational analysis of the United

Kingdom Prospective Diabetes Study (UKPDS) data showed that the risk of each of the macrovascular and microvascular complications of type 2 diabetes was strongly associated with mean systolic BP. On an average, each 10-mm Hg reduction in systolic BP was associated with a 12% decrease in the risk of any endpoint RIAC (renal insufficiency and cardiovascular events) study group showed that both microvascular and macrovascular complications are significantly more prevalent in patients with diabetes who also have hypertension than in those without hypertension. As reported and confirmed in clinical trials, lowering blood pressure to less than 140 / 80 mm Hg in diabetes patients reduces cardiac events, stroke, and nephropathy[12]. When treating hypertension in people with diabetes, clinicians target a lower BP (130/ 80mmhg) to reduce the likelihood of cardiac events and stroke[13].

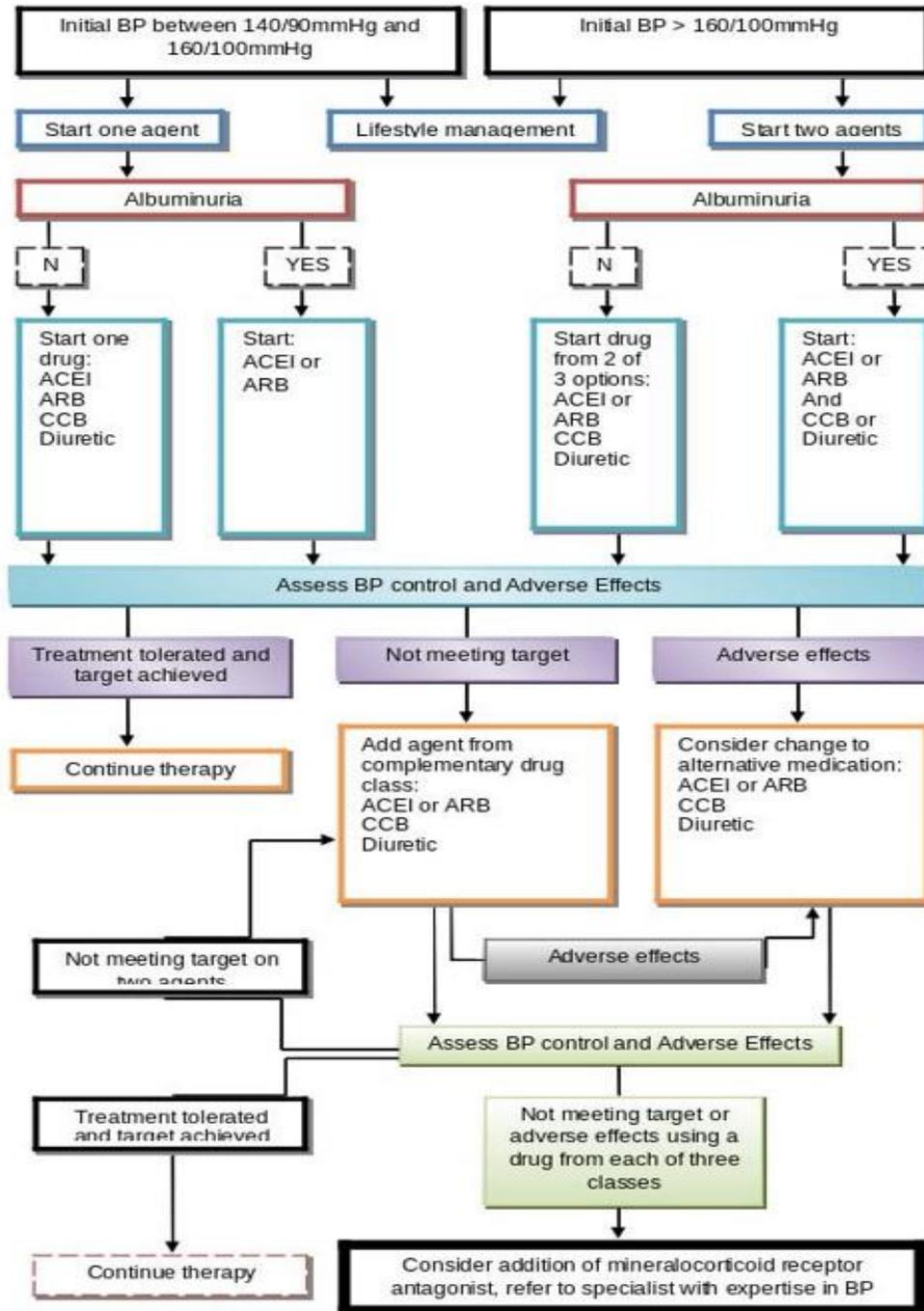
A large cohort study assessed the risk of cardiovascular disease (CVD) mortality associated with diabetes that reported diabetes as a robust and independent risk factor for CVD mortality. Systolic blood pressure (SBP) was positively related to the risk of CVD death. Crude chronic heart disease (CHD) and CVD death rates were approximately five times higher in men with diabetes compared with men without diabetes[14].

**MANAGEMENT:**

**Pharmacological treatment:**

**Figure 3: Algorithm for the treatment of HTN associated with DM in regard to severity and blood pressure parameters**

**Figure 3: Treatment regimen as per severity and blood pressure levels**



It is known that drug classes of antihypertensive medications differ in their blood pressure lowering efficacy and in some instances in their clinical outcomes e.g., cardiac and renal protection and lowering of proteinuria. In JNC 7 guidelines, the selection of appropriate pharmacologic drug classes for the treatment of hypertension in those suffering from diabetes mellitus is addressed; however, the guidelines don't consider the race. They recommend classes such as diuretics, ACE inhibitors, beta-blockers, ARBs, and CCBs[15] The Eighth report of the Joint National committee also talked about the selection of drug classes; however, it considered

potential differences in blood pressure lowering efficacy depending on race, particularly in the black population. The guidelines recommended thiazide-type diuretics, ACE inhibitors, ARBs, or CCBs as initial therapy for non-black patients with diabetes mellitus.

#### Targeting BP for diabetes and hypertension:

As reported and confirmed in clinical trials, lowering blood pressure to less than 140/80 mm Hg in diabetes patients reduces cardiac events, stroke and nephropathy. When treating hypertension in diabetics, clinicians target a lower BP (130/80mmHg) to reduce the likelihood of cardiac events and stroke.

**Table 5: SYSTEMATIC REVIEW OF DIFFERENT STUDIES WITH TREATMENT STRATEGIES AND OUTCOMES REPORTED.**

Clinical Trial	Population	Intensive	Standard	Outcome
<b>ACCORD BP</b>	Four thousand seven hundred thirty-three participants with T2D aged 40-79 years with prior evidence of CVD or multiple cardiovascular risk factors.	Systolic blood pressure target: <120mmHg achieved (mean) systolic/diastolic: 119.3/64.4mmHg	Systolic blood pressure target: 130-140mmHg achieved (mean) systolic/diastolic: 133.5/70.5mmHg	No benefit in primary endpoint: composite of nonfatal MI, nonfatal stroke, and CVD death. Stroke risk reduced 41% with intensive control, not sustained through follow-up beyond the period of active treatment. Adverse events more common in the intensive group particularly elevated serum creatinine and electrolyte abnormalities
<b>ADVANCE BP</b>	11,140 participants with T2D aged 55 years and older with prior evidence of CVD or multiple Cardiovascular risk factors	Intervention: A single-pill, fixed-dose combination of perindopril and indapamide. Achieved (mean) systolic/diastolic: 136/73mmHg	Control: placebo achieved (mean) systolic/diastolic: 141.6/75.2mmHg	The intervention reduced risk of the primary composite endpoint of major macrovascular and microvascular events (9%), death from any cause (14%), and mortality from CVD (18%) The 6-year observational follow-up found a reduction in risk of death in intervention group attenuated but still significant
<b>HOT</b>	18,790 participants, including 1,501 with diabetes	Diastolic blood pressure target: #80mmHg	Diastolic blood pressure target: #90mmHg	In the overall trial, there was no cardiovascular benefit with more intensive targets In the subpopulation, with diabetes, an intensive diastolic target was associated with a significantly reduced risk (51%) of CVD events
<b>UKPDS</b>	1,148 patients with hypertension and newly diagnosed type 2 diabetes	Less intense: 154/87mmHg; more intense: 144/82mmHg	Tight blood pressure control (<150/85mmHg) or less strict blood pressure control (<180/105mmHg)	Diabetes-related endpoints (34%) and deaths (32%); stroke (44%); microvascular events (37%)

**ROLE OF CLINICAL PHARMACIST:**

The functional triage role of clinical pharmacists includes providing pharmaceutical care, enhancing medication management, and ADR monitoring. Pharmaceutical care services include analyzing drug-related problems regarding cost-effectiveness, better outcome, safety, and efficacy. Medication management includes strategies for the selection of drugs, applicable drugs, ADR monitoring, and assessing drug-drug interactions, drug-food interactions to accomplish safe, efficient, and cost-effective therapy[16]. Also, an essential resource of patient counseling can gradually decrease the risk of medicine mismanagement, non-compliance, and non-adherence. The advantage is also added in the case of prescribing by implementing rational drug use and addressing ADR, interactions, and patient counseling information. A cluster Randomized controlled pragmatic trail was conducted to study the adherence and intensification of medication and it was found that there was a rapid decrease in SPB levels after 6 months of intervention period. This shows the importance of evaluating clinical settings leading to improved blood pressure control by clinical pharmacist in HTN and DM[17]. Some studies showed that clinical pharmacist intervention among rural population has a very strong positive impact in creating awareness about the disease, improving medication adherence and QOL. Pharmacist involvement/need is very important in other chronic disease managements by increasing the QOL by preventing recurrence of disease, its progression, and minimizing of hospital admissions [18] [19].

**Control of diabetes:**

As the available therapeutic agent to treat diabetes has rapidly expanded over years, the role of clinical pharmacist in caring and monitoring the patient has also expanded. Pharmacist can play a key role by providing necessary information and keeping a track of the blood glucose levels [20]. This necessary information includes, counseling regarding proper use of insulin, regarding disease, regarding drugs, lifestyle modifications and on complications (acute and chronic). The proper use of insulin includes the range from drawing the insulin from vial to self-administering and storage/disposal. Counseling regarding drugs includes dosage form, route of administration, schedule, possible side effects (dizziness, restlessness, nausea etc.) and adding final comments on how to treat the side effects with home remedies. This advice can decrease the panic of the patient and provides an idea.

**Medication history:**

Precisely documenting a patient's medication profile with allergies at the time of admission improves the quality and effectiveness of patient care and prevents medical errors. Pharmacists are best suited for this aspect as they are more familiar with drug names, characteristics, effects, dosage form and administration. This concept can optimize a patient's drug therapy through clinical interventions. These insights may reduce drug interactions and duplications which can occur from prescribers if they are not aware of the patient's complete list past medications. A complete allergy profile is also important for patient safety and to reduce the side effects and ADR [21]. Another key advantage of medication history is the patient's use of nonprescription medications and herbal therapies. Targeting the service to certain populations with more drug-related complications, such as the elderly and patients admitted for adverse drug reactions, may make the service more efficient. Although there is evidence in the biomedical literature that pharmacist-conducted medication histories are more accurate and adds advantage save money, and increase patient safety, this service is not widely implemented in many hospitals[22,23,24].

**Patient counseling:**

Patient counseling is the process of advising patients. It is the prime responsibility of a pharmacist to advise the patients regarding the use of drugs while dispensing. The primary goals of HTN and DM management are to reduce the risk for microvascular and macrovascular disease complications, to ameliorate symptoms, to reduce mortality, and to improve quality of life. Appropriate care requires goal setting for glycemia, blood pressure, and lipid levels, regular monitoring for diabetic complications, dietary and exercise modifications, appropriate medications, appropriate self-monitoring of blood glucose (SMBG), and laboratory assessment of the parameters above[25]. Studies have confirmed that the complications of diabetes can be reduced by proper control of blood glucose. It is dependent on the patient's adherence to medications, lifestyle modifications, frequent monitoring of blood glucose, etc. It can be influenced by proper education and counseling of the patient. Pharmacists, being one of the indispensable members of the healthcare team, have an immense responsibility for counseling these patients. The patient care process involves the pharmacist initiating a relationship with the patient, gathering and assessing information, developing a patient care plan, complete intervention by

communicating with the patient and implementation of follow-up[26].

#### **Lifestyle modifications:**

**Exercise and physical activity** - Regular physical activity is strongly recommended in patients with cardiovascular diseases. The activity should be individualized based on the patient's capacity. Promoting adherence to an exercise goal of 30 minutes of moderate exercise, 5-7 days a week with warm or cool up exercise is essential. Once clinically stable, patient should be encouraged to carry out daily physical activities and leisure activities that do not induce or worsen symptoms. Physical exercise aids in weight loss and maintains ideal body weight along with proper balanced diet. In type 2 diabetes, the desired level of exercise is 50% to 80% of maximal uptake of oxygen three to four times a week. The standard exercise recommendation for diabetes should be as per the American Diabetes Association (ADA). It is essential to monitor blood glucose and blood pressure before and after exercise. Exercise is not recommended if the patient has poorly controlled labile blood glucose level or is at increased risk of diabetic and CVD complications [27].

#### **Weight monitoring:**

Increase in body weight is associated with deterioration of HF and fluid retention. Weight reduction should not routinely be done in patients with moderate to severe heart failure since unintentional weight loss and anorexia are common problems. The goal BMI is 25-27 kg/m<sup>2</sup>. Goal of waist measurement is <94cm in men and <80cm in women. If there is a sudden weight gain of >2kgs in 3 days, the physician should be informed and diuretic dose may need to be adjusted. Dietary management has been effective in reducing blood pressure as well as blood sugar levels, and several controlled studies have looked at the relationship between weight loss and blood pressure reduction. Weight reduction can lower blood pressure independent of sodium intake and also can improve blood glucose and lipid levels. The loss of one kilogram in body weight has resulted in decreases in mean arterial blood pressure of ~1 mmHg[28]

#### **Smoking cessation:**

The primary goal is complete cessation of smoking and avoidance of passive smoking. Diabetes and hypertensive patients (>40 years) have high cholesterol levels and are at a higher risk of cardiovascular diseases. This free cholesterol in blood gets accumulated in the arteries and blocks the blood flow resulting in heart attack and stroke. This blockage

may also occur in the small arteries that supply blood to the legs and feet. Smoking can also lead to serious complications like infections, ulcers, gangrene, and even amputations. Pharmacist should counsel patients regarding the evil effects of smoking and educate the patients regarding the various strategies to stop smoking. This can also be achieved by providing cessation programs and pharmacotherapy (nicotine replacement, bupropion).

#### **Diet modification:**

**Sodium restriction** - One of the important strategies to lower hypertension and its complications is curbing salt intake. Developed countries like Finland, the UK, Australia and Canada have been campaigning for salt reduction. Sodium restriction has not been tested in the diabetic population in controlled clinical trials. However, results from controlled trials in essential hypertension have shown a reduction in systolic blood pressure of ~5 mmHg and diastolic blood pressure of 2-3 mmHg with moderate sodium restriction (from a daily intake of 200 mmol [4,600 mg] to 100 mmol [2,300 mg] of sodium per day). A dose-response effect has been observed with sodium restriction. Even during pharmacotherapy, there is often an enhanced patient complete response (Pcr) with salt reduction (ADA). The salt intake for an individual is 10-15 grams per day. There is a paucity of recent data in the country about the sodium content of processed food. The WHO's recommendation on salt intake from all sources is less than 5 grams per day[29]. Sodium is present in natural food, gets added while cooking, and also used as a preservative for processed food. One way of reducing sodium intake in your diet is by increasing the potassium intake, ultimately lowering the blood pressure. There are various benefits for potassium-enriched salts but the risk weighs on stroke, hyperkalemia and worsening of CKD. It is found to lower systolic and diastolic blood pressure (average net  $\Delta$  [95% CI] in mm Hg: -5.58 [-7.08 to -4.09] and -2.88 [-3.93 to -1.83], respectively)[30]. It is essential to educate the patient and their caregivers about harmful effects of salt and associated advantages with salt reduction for hypertensive and diabetes disease. Also endowing the differences about myths and facts will help them to adhere to the concept of advice.

#### **Alcohol cessation:**

Alcohol is a direct myocardial toxin and may impair cardiac contractility. It may have negative inotropic effect and is associated with BP and increased risk of arrhythmia. Factsheets, Randomized Controlled Trails, preclinical and clinical studies have recognized the interconnection between high alcohol consumption

and hypertension. The resulting loss of relaxation due to inflammation and oxidative injury of the endothelium leads to inhibition of endothelium-dependent nitric oxide production following by alcohol-induced hypertension. Physical conditioning/exercise training is the most important strategies to prevent/treat chronic alcohol-induced hypertension. The efficacious pharmacologic treatment includes the angiotensin-converting enzyme (ACE) inhibitors or angiotensin II type 1 receptor blockers (ARBs). It is very important to educate people about the alcoholic units for gin, rum, vodka, whisky etc., and its associated increase in blood pressure. It is essential to reduce the alcohol intake and to maintain the lower standard units accordingly (The Dietary Guidelines also recommend that if alcohol is consumed, it should be in moderation—not more than 13 units a week) (CDC). In case of alcoholic substance abuse, the patient or caregiver should be advised regarding rehabilitation centers and its benefits.

#### **Fluid restriction:**

limit the fluid intake to 1.5-2L/day in patients with severe hypertension to relieve symptoms. Fluid restriction in mild-moderate hypertension is not beneficial.

#### **Caffeine:**

Excessive caffeine intake may increase heart rate, blood pressure and exacerbate arrhythmia. Limit caffeine beverages to 1-2 cups/day.

#### **Carbohydrates:**

The blood glucose level and blood pressure are closely associated with carbohydrate intake. Most young people will require 180 g of carbohydrate per day, whereas 100 g may suffice for an elderly patient. People with diabetes should limit their sugar intake, but total exclusion of sugar is impractical and unnecessary.

#### **Fat:**

Increased fat intake with CVD results in increased CAD incidence and death, thus it is wise to restrict saturated fats and to substitute them with unsaturated fats. More severe restrictions may be indicated for individuals with hypercholesterolemia.

#### **Fiber:**

Dietary fiber has two functional properties. Firstly, increases satiety and secondly, fiber delays the digestion and absorption of complex carbohydrates, thereby minimizing hyperglycemia. For an average person with NIDDM, 15gm of soluble fiber (from

fruits, pulses and vegetables) is likely to produce a 10% improvement in fasting blood glucose, glycated hemoglobin and low-density lipoprotein cholesterol.

#### **Counseling regarding self-monitoring of glucose and blood pressure:**

With the availability of Blood glucose and blood pressure monitoring devices patients can have a control over their disease condition. Pharmacists can help right from choosing a proper glucose and blood pressure monitor, training them in proper use. Pharmacist can explain the significance of various blood glucose and blood pressure levels.

#### **ADR MONITORING:**

ADRs are one of the major drugs related problems being considered as the important cause of hospital-related admissions and are a challenge for drug safety. The results of the study stated that in a sample size of 503 patients screened and monitored, ADR for 69 anti-diabetic (67.64%) and 9 anti-hypertensive (8.82) were reported. In which a few drugs were changed, withdrawn and symptomatic therapy was given. Clinical pharmacist attribution to ADR is not only limited to monitoring and [31] reporting but also is extended towards the severity assessment, prevention and management of ADR. These study results provide insight to the healthcare providers on the importance of monitoring and reporting of ADRs especially in elderly patients with diabetes mellitus. The active involvement of clinical pharmacist for detecting and monitoring ADRs and their management through therapeutic interventions would be beneficial in the better patient therapeutic outcome, follow-up of patients, educating them and dissemination of information to the health care team [32].

#### **CONCLUSION:**

The two foremost lifestyle diseases are diabetes and hypertension which serves as a substructure for the evolution of other major dangerous diseases such as chronic kidney disease, stroke, CAD etc., which are fatal and are at the high level of mortality. Targeting multiple risk factors is crucial in preventing and slowing the progression of these complications. Appropriate education and awareness among the patient and caregivers can result in stunning outcomes. Thus, the initial approach to the management of both diabetes and hypertension must emphasize weight control, physical activity, medication adherence, drug monitoring, dietary modification. Interestingly, lifestyle intervention is remarkably effective in the primary prevention of diabetes and hypertension. Health care systems should be strengthened for early

detection and effect treatment of those affected with both diabetes mellitus and hypertension which can be only achieved by proper health literacy among general public. In contrast that patient don't get to spend enough time with physician, only clinical pharmacist from the health care team can keep the track in effective ways and to bridge the gap between the patients and the health care team.

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