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A COMPARATIVE ANALYSIS OF DIABETES PATIENTS: PREVALENCE AND OUTCOMES DURING THE COVID- 19 PANDEMIC AND CURRENT TRENDS

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INTRODUCTION

Overview of Diabetes as a Health Condition Definition and Types of Diabetes Diabetes is a health disorder that disrupts the normal process of glucose utilization in the body, where glucose serves as the main sugar for cell energy. Various forms of diabetes exist, each characterized by distinct causes and treatment approaches.[1,2,3,4]

Type of Diabetes	Description	Characteristics	Management
Type 1 Diabetes	An autoimmune disease where the immune system attacks and destroys pancreatic cells producing insulin.	Develops in childhood/young adulthood. Exact cause unknown, potentially genetic and environmental factors.	Daily insulin injections required for survival.
Type 2 Diabetes	Most common type, characterized by insufficient insulin production or ineffective use in the body, leading to elevated blood sugar levels.	Affects about 90% of people with diabetes. Linked to obesity, physical inactivity, family history, and aging.	Managed with lifestyle changes (diet, exercise, weight loss) and medications (oral or injectable).
Gestational Diabetes	Develops during pregnancy, causing high blood sugar levels.	Affects 2% to 10% of pregnant women. Increases risk of complications for both mother and baby.	Controlled with diet, exercise, and sometimes medication during pregnancy; typically resolves after childbirth but raises the risk of future type 2 diabetes.
Other Types of Diabetes	Rare forms resulting from genetic mutations, pancreatic diseases, hormonal disorders, or medications.	Includes monogenic diabetes, cystic fibrosis-related diabetes, latent autoimmune diabetes in adults, and drug-induced diabetes. Differ in features and treatments based on underlying causes.	Treatment tailored to specific type and underlying cause.

The pathophysiological comprehension General Mechanism of Diabetes Mellitus Diabetes mellitus arises when the body encounters challenges in transferring glucose from the bloodstream into cells. This leads to elevated blood glucose levels and insufficient levels within cells, both crucial for energy production. Despite the presence of glucose, energy depletion occurs due to its incapacity to enter cells.[45]

Insulin Function: Insulin attaches to insulin receptors present in insulin-responsive tissues like muscle and adipose tissue to reduce blood glucose levels. Activation of insulin receptors facilitates the movement of glucose transporters to the cell membrane, allowing for the entry of glucose.[45]

Type 2 Diabetes Mellitus: In Type 2 diabetes, the body manufactures insulin, but the tissues exhibit resistance to it. Insulin resistance results from the cells' incapacity to relocate their glucose transporters to the membrane.[45]

Consequences of Insulin Production: To compensate for the diminished tissue response, the body increases insulin production. Beta cell hyperplasia and hypertrophy occur to enhance insulin secretion, temporarily sustaining normal blood glucose levels.[45]

Beta Cell Dysfunction: Due to prolonged stress-induced exhaustion, beta cells produce less insulin. Diminished insulin secretion results in elevated blood glucose levels, leading to hyperglycemia.[45]

Pancreatic Beta Cells and Insulin Release: The intricate process involves beta cell calcium ion channels and ATP-sensitive potassium channels. Upon the breakdown of glucose into ATP, potassium channels close, permitting calcium influx and triggering insulin release.[45]

Insulin Response: The insulin released facilitates the absorption of glucose by binding to receptors in various tissues.[45]

Type 2 Diabetes and the functionality of beta cells

Within the context of diabetes mellitus type 2, reduced sensitivity of ATP-sensitive potassium channels leads to diminished beta cell depolarization and decreased insulin release.[45]

Diagnosis

Diagnostic Test	Interpretation
Glycated Hemoglobin (A1C) Test.	
	- Below 5.7%: Normal
	- 5.7% to 6.4%: Prediabetes
	- 6.5% or higher (on two tests): Diabetes
Random Blood Sugar Test.	
	- 200 mg/dL (11.1 mmol/L) or higher suggests diabetes. May be combined with symptoms like frequent urination and extreme thirst.
Fasting Blood Sugar Test.	
	- Less than 100 mg/dL (5.6 mmol/L): Healthy
	- 100 to 125 mg/dL (5.6 to 6.9 mmol/L): Prediabetes
	- 126 mg/dL (7 mmol/L) or higher (on two tests): Diabetes
Oral Glucose Tolerance Test.	
	- Less than 140 mg/dL (7.8 mmol/L) after two hours: Healthy
	- 140 to 199 mg/dL (7.8 to 11.0 mmol/L) after two hours: Prediabetes
	- 200 mg/dL (11.1 mmol/L) or higher after two hours: Diabetes
Screening Recommendations.	
	- Routine screening for type 2 diabetes in:
	- Adults age 35 or older
	- People younger than 35 who are overweight/obese with diabetes risk factors
	- Women with a history of gestational diabetes
	- Individuals previously diagnosed with prediabetes
	- Overweight/obese children with family history or risk factors for type 2 diabetes

Diabetes Incidence and Global Impact: As per the World Health Organization's data, the number of individuals with diabetes worldwide reached 422 million in 2014, a significant increase from 108 million in 1980. The escalation in prevalence has been more rapid in low- and middle-income countries compared to high-income nations.[5]

Diabetes stands as a major contributor to conditions such as lower limb amputation, heart attacks, strokes, blindness, and renal failure. In 2019, an estimated 2 million deaths were linked to diabetes and renal disease.[5]

According to the International Diabetes Federation, 10.5% of adults (aged 20–79) are dealing with diabetes, with nearly half being unaware of their condition. Projections from the IDF indicate that by 2045, 783 million adults—equivalent to 1 in 8 of the global population—will have diabetes, representing a 46% increase.[6]

Type 2 diabetes, resulting from a blend of genetic, environmental, demographic, and socioeconomic factors, impacts over 90% of the diabetic population. Conversely, the severity of diabetes can be mitigated through the prevention of diabetes type 2 and the proper management of all forms of the condition, facilitated by timely treatment and diagnosis.[5]

Epidemiology and Risk Factors

Statistics Regarding Diabetes Prevalence in Different Parts of India: As reported by the International Diabetes Federation, 10.5% of adults aged 20 to 79 have diabetes, with almost half of them unaware of their condition. IDF projections anticipate that by 2045, 783 million adults, equivalent to 1 in 8 of the population, will be affected by diabetes, reflecting a 46% increase.[7]

Approximately 77 million individuals in India aged 18 and above are affected by type 2 diabetes, while an additional 25 million are considered prediabetic, indicating a higher likelihood of developing the condition soon. Over half of this population is unaware of their diabetes status, which poses potential health risks if not promptly identified and treated. With a 17.1% share of global diabetes cases, India holds the second-highest prevalence of the disease. Geographically, diabetes rates in India vary, with urban areas and southern states exhibiting the highest prevalence. For instance, diabetes prevalence ranges from 3.6% in rural Jharkhand to 25.2% in metropolitan Delhi.[9]

Region	Highest Prevalence	Contributing Factors
South India	Tamil Nadu (13.7%), Andhra Pradesh (12.1%), Kerala (12.0%)	Rapid urban growth leading to sedentary lifestyles and dietary shifts. Increased genetic susceptibility. Unequal access to healthcare and healthy foods.
North India	Punjab (9.0%), Jammu & Kashmir (7.1%)	More reliance on traditional diets with whole grains and legumes. Rural lifestyles involving greater physical activity.
East India	West Bengal (9.9%), Odisha (8.2%)	Varying levels of urbanization impacting prevalence. Socioeconomic disparities affecting access to healthcare and healthy food.
West India	Maharashtra (12.4%), Gujarat (7.7%)	High prevalence in urban areas such as Mumbai and Pune. Differences in prevalence based on rural-urban demographics.

Regional Disparities in Diabetes Prevalence: Urban versus Rural Disparity: The occurrence of diabetes among urban inhabitants in India is roughly fivefold higher (15.1% compared to 2.7%) in comparison to those residing in rural areas.[10,11,12]

Complexities in Regional Disparities: The prevalence of diabetes is influenced by factors such as socioeconomic status, lifestyle choices, genetic predispositions, and healthcare accessibility.[10,11,12]

Variability within Regions: Within individual states, the prevalence of diabetes can significantly differ based on specific districts and demographic factors.[10,11,12]

Risk Factors Contributing to Diabetes Development: Diabetes manifests in diverse forms, each with distinct risk factors. Certain risk factors pertain to particular types, while some are shared among all variations. Type 1 diabetes, presumed to be triggered by an immune response resulting in the damage to pancreatic cells tasked with generating insulin, presents unique risk factors. While the exact factors behind type 1 diabetes are not completely comprehended, age, race, and ethnic background may contribute. The likelihood of developing type 1 diabetes is elevated if an individual has a family member—parent, sibling, or child—with the condition. While type 1 diabetes can affect individuals of any age, it predominantly emerges in children, teenagers, or young adults. Importantly, type 1 diabetes is currently considered not preventable.[13]

Type 2 diabetes, the primary factors leading to type 2 diabetes are diminished insulin production and insulin resistance. A majority of the factors that increase the risk of developing type 2 diabetes are linked to health conditions and lifestyle choices. It is feasible to modify some of these risk factors through adopting a healthy diet, engaging in regular exercise, and managing weight.[13,14]

Risk Factors	Description
Prediabetes	Higher-than-normal blood sugar levels, not diagnosed as diabetes. Increases the risk of developing Type 2 diabetes.
Being overweight or obese	Excessive body weight increases the body's resistance to insulin, a key factor in the development of Type 2 diabetes.
Age 45 years or older	The risk of Type 2 diabetes increases with age, particularly after reaching 45 years.
Family history of type 2 diabetes	Having a close relative, such as a parent or sibling, with Type 2 diabetes increases the risk. Genetics can play a significant role.
Physical inactivity	Lack of regular physical activity contributes to weight gain and increases the risk of insulin resistance.
Gestational diabetes or a baby who weighed more than 9 pounds at birth	Previous occurrence of gestational diabetes or giving birth to a baby over 9 pounds increases the risk.
Polycystic ovary syndrome (PCOS)	Hormonal disorder in women that can increase the risk of insulin resistance and Type 2 diabetes.
Non-alcoholic fatty liver disease	Accumulation of fat in the liver can lead to insulin resistance and an increased risk of Type 2 diabetes.

Gestational diabetes: This specific type of diabetes emerges solely during pregnancy, affecting both the mother and the child. Factors that elevate the risk of gestational diabetes include a history of previous occurrences, delivering a baby weighing over nine pounds, being overweight or obese, age over twenty-five, a familial background of type 2 diabetes, and having Polycystic ovary syndrome, abbreviated as PCOS. While gestational diabetes usually resolves following childbirth, it heightens the future likelihood of developing type 2 diabetes for both the mother and the child. Adhering to a healthy diet, monitoring blood sugar levels, and using medication as needed can all contribute to preventing or managing gestational diabetes.[13,15]

Ethnic Groups and their Susceptibility to Different Diabetes Types

Type of Diabetes	Ethnic Group
Type 1 Diabetes	- Commonly develops in children, teens, or young adults. More prevalent among White individuals compared to African American and Hispanic or Latino individuals.
Type 2 Diabetes	- Higher occurrence among African American, Hispanic or Latino, American Indian, Alaska Native, Native Hawaiian, Pacific Islander, or Asian American individuals. Increased risk for African American, Hispanic or Latino, American Indian, Alaska Native, Native Hawaiian, or Pacific Islander ethnic groups.
Gestational Diabetes	- Increased risk among African American, Hispanic or Latino, American Indian, Alaska Native, Native Hawaiian, or Pacific Islander ethnic groups.

Health Implications and Complications of Diabetes: The enduring consequences of consistently elevated levels of blood sugar are referred to as the chronic health effects of diabetes. Diabetes can adversely affect various bodily systems and organs, including the heart, kidneys, eyes, nerves, feet, and skin. Common issues associated with diabetes include.[15,16,17]

Complication	Description
Heart disease and stroke	Diabetes increases the risk of high blood pressure, high cholesterol, and atherosclerosis (hardening of the arteries), potentially leading to heart attacks and strokes.
Kidney disease	Diabetes can damage the kidneys' filtering units, causing a loss of function that may eventually require dialysis or transplantation.
Nerve damage	Diabetes affects nerves controlling sensation, movement, and organ function, resulting in numbness, pain, weakness, and digestive problems.
Eye problems	Diabetes can damage blood vessels in the retina, causing vision loss, cataracts, and glaucoma.
Foot problems	Reduced blood flow and sensation in the feet due to diabetes can lead to ulcers, infections, and sometimes necessitate amputations.
Skin problems	Diabetes can impair the skin's healing ability and resistance to infections, causing various skin conditions like fungal infections, bacterial infections, and diabetic dermopathy.
Mental health	Diabetes can impact mood, memory, and cognitive function, increasing the risk of depression, anxiety, and dementia among individuals with diabetes.

Impact of Diabetes on the Overall Well-being: A person's ability to function and derive satisfaction from life is gauged through their health-related quality of life (HRQOL pertains to the general state of health and well-being). This encompasses aspects such as social, mental, emotional, and physical well-being.[19]

Diabetes mellitus (DM) negatively impacts HRQOL by diminishing the physical, psychological, environmental, and social dimensions of health. Individuals with diabetes, in comparison to those without the condition, experience heightened levels of pain, fatigue, emotional distress, including sadness, anxiety, stress, and also feelings of stigma and loneliness.[18,20,21]

Several factors influence the well-being related to HRQOL of individuals with DM, encompassing marital status, age, gender, education, and income, duration of diabetes, type of treatment, glycemic control, presence of complications and co-morbidities, lifestyle choices, self-care routines, social support, and coping mechanisms.[18,20,21]

Enhancing the health-related quality of life (HRQOL) for individuals with diabetes necessitates a comprehensive approach that extends beyond medical aspects to tackle or handle psychological, social, and environmental dimensions of the condition. Implementing a comprehensive strategy involves regular screening, check-ups, educational initiatives, optimal glycemic control, preventive measures, and management of complications and co-morbidities. Additionally, incorporating physical activity, sustaining a nutritious eating plan, practicing foot care, ceasing smoking and limiting alcohol intake, stress management, fostering self-empowerment, cultivating a positive outlook, engaging in social interactions, assistance from both family members and healthcare professionals are essential elements.[18,19,20,21]

Impact of Diabetes on life expectancy: Diabetes can significantly influence life expectancy, though the extent of its impact varies based on several factors such as.[22,23,24,25,26,27,28,29]

Aspect	Impact on Life Expectancy
Type 1 diabetes	Traditionally, individuals with type 1 diabetes had shorter life expectancies. However, advancements in medical care and management strategies have dramatically improved outcomes. Many individuals with type 1 diabetes can now expect to live near-normal lifespans.
Type 2 diabetes	The impact of type 2 diabetes on life expectancy is often more substantial than for type 1. Uncontrolled type 2 diabetes can shorten life expectancy by an average of 5-10 years. However, effective management, including blood sugar control, healthy lifestyle choices, and proper medication adherence, can significantly improve life expectancy and bring it closer to that of healthy individuals.
Age of diagnosis	Early diagnosis and intervention play a pivotal role in minimizing the long-term consequences of diabetes. Studies have shown that early diagnosis and prompt management can significantly reduce the risk of complications and increase life expectancy.
Severity of complications	Diabetes can lead to various complications, including heart disease, stroke, kidney disease, and nerve damage. The presence and severity of these complications significantly impact life expectancy. However, proper management and control of diabetes can prevent or delay the onset of these complications, thereby improving life expectancy.
Other health factors	Pre-existing conditions and additional health factors, such as high blood pressure, smoking, and obesity, can further exacerbate the impact of diabetes on life expectancy. Addressing these factors through proper management and healthy lifestyle choices is crucial in mitigating their adverse effects.

Overview of standard therapies

Two primary aspects of diabetes management

a) **Lifestyle Changes Dietary Management:** A comprehensive grasp of carbohydrate counting and portion sizes is crucial, given that carbohydrates significantly impact blood sugar levels. This becomes particularly crucial for accurate insulin dosing in individuals requiring insulin during meals. Emphasizing well-balanced meals that include appropriate proportions of carbohydrates, fruits, vegetables, proteins, and fats is paramount. Opting for carbohydrates from fruits, vegetables, and whole grains is recommended due to their lower impact on blood sugar and higher fiber content, which aids in stabilizing blood sugar levels. Aligning meal timing with diabetes medication is essential to prevent hypo- or hyperglycemic episodes. Additionally, recognizing the minimal nutritional value, high calorie content, and rapid increased blood sugar linked to sugar-sweetened beverages underscores the importance of avoiding them for effective diabetes control.[30]

Alcohol Consumption: Consulting a physician is recommended to assess the suitability and restrictions of alcohol consumption based on individual health considerations. Consuming alcohol moderately alongside simultaneous food intake can help counteract its tendency to lower blood sugar levels.[30]

Exercise Regimen: Engaging in regular physical activity offers numerous benefits in diabetes management, such as enhancing insulin sensitivity and lowering blood sugar levels. Furthermore, consistent exercise regimens contribute to reducing blood pressure, fostering optimal cholesterol levels, improving cardiovascular health, and diminishing the risk of complications like heart disease and stroke. Notably, exercise also positively impacts mood, overall health, and strengthens bones and muscles, thereby delaying the onset of issues associated with diabetes.[30]

Stress Management: Systematically identifying stress triggers aids in the development of coping mechanisms or intentional avoidance strategies. Additionally, incorporating relaxation techniques such as yoga, tai chi, meditation, or deep breathing exercises assists in managing blood sugar levels and effectively alleviating stress.[30]

b) **Medications:** The management of diabetes mellitus with medications is influenced by factors like blood sugar levels, diabetes type, and various other variables. Typically, the following measures are essential.

In the case of those diagnosed with type 1 diabetes, insulin replacement through injections or an insulin pump is necessary. The utilization of insulin therapy helps prevent ketoacidosis; a potentially life-threatening condition caused by elevated blood acid levels.[33,34]

In the case of those with type 2 diabetes aiming to reduce blood sugar levels, oral medications such as DPP-4 inhibitors, sulfonylureas, or metformin may be prescribed. These medications operate through diverse mechanisms, including enhancing insulin production, reducing glucose synthesis, or promoting cell absorption of glucose. In cases where oral medications prove insufficient to manage blood sugar levels, insulin therapy may be required.[31,32,34]

Individuals with gestational diabetes, a condition emerging during pregnancy, might need insulin injections or oral medications to regulate blood sugar levels and prevent complications for both themselves and their unborn children. Although levels of blood sugar often return to normal after childbirth, pregnant women experiencing gestational diabetes at a higher risk of the prospect of developing type 2 diabetes in the future.[34]

Management with Insulin: Administering insulin for diabetes management requires careful selection of the appropriate insulin type, dosage, and administration method to achieve optimal management of blood sugar levels. Depending on the extent and kind of diabetes, insulin therapy may be employed as an adjunct to oral medications or as a substitute for them. Various factors influencing insulin management include.[35]

Aspects of Insulin Management	Details
Types of Insulin	- Rapid-acting, short-acting, intermediate-acting, and long-acting insulin with different onset, peak, and duration of action. - Variations in use and combinations tailored to individual needs.
Dose Adjustment	- Insulin dosage depends on factors such as blood sugar levels, carbohydrate intake, physical activity, and concurrent medications. - Frequent adjustments based on self-monitoring of blood glucose (SMBG) or continuous glucose monitoring (CGM) results.
Methods of Administration	- Administered via injections, pens, pumps, or inhalers. - Each method has unique advantages, drawbacks, and necessitates proper education and training for safe and effective usage.
Healthcare Provider Involvement and Lifestyle Adherence	- Regular follow-up and consultation with healthcare providers for devising individualized plans. - Guidance and support from healthcare professionals. - Adherence to a balanced diet, regular exercise, stress management, and healthy lifestyle.

Effectively managing insulin in diabetes requires regular check-ups and consultations with a medical professional, who can provide assistance, formulate a personalized strategy and provide guidance and support. Additionally, it is crucial to uphold a healthy lifestyle, encompassing stress reduction, consistent exercise, and a well-balanced diet, for effective insulin management.

Management with Oral hypoglycemic: Oral hypoglycemic drugs aim to reduce blood glucose levels among those diagnosed with type 2 diabetes or prediabetes. Their actions involve various mechanisms, such as enhancing glucose excretion, reducing insulin resistance, inhibiting glucose absorption, and promoting insulin secretion. These medications for lowering blood sugar orally are classified into five primary categories.[37]

Type of Oral Hypoglycemics	Mechanism of Action	Examples	Effects
Sulfonylureas	Stimulate pancreas to produce more insulin. Can lower blood glucose levels by 1 to 2 percent (mmol/L).	Glipizide, Glyburide, Glimepiride	Weight gain, low blood sugar, allergic reactions
Meglitinides	Also stimulate insulin secretion, acting faster and for a shorter duration than sulfonylureas. Taken before meals to prevent postprandial hyperglycemia.	Repaglinide, Nateglinide	Low blood sugar, weight gain, headache
Biguanides	Reduce glucose production by the liver and increase glucose uptake by muscles. Can lower blood glucose levels by 1 to 2 percent (mmol/L).	Metformin	Gastrointestinal side effects (nausea, diarrhea, bloating), may lower vitamin B12 levels
Thiazolidinediones	Improve insulin sensitivity by activating a nuclear receptor regulating glucose and lipid metabolism. Can lower blood glucose levels by 0.5 to 1.4 percent (mmol/L).	Pioglitazone, Rosiglitazone	Weight gain, fluid retention, increased risk of heart failure or fractures
Alpha-glucosidase inhibitors	Delay digestion and absorption of carbohydrates in the small intestine. Can lower blood glucose levels by 0.5 to 0.8 percent (mmol/L).	Acarbose, Miglitol	Flatulence, abdominal pain, diarrhea

Newer categories of oral hypoglycemics, such as GLP-1 receptor agonists, SGLT2 inhibitors, and DPP-4 inhibitors, offer unique mechanisms and benefits. However, their availability is not universal, and they might be more expensive or associated with increased side effects.[37]

Oral hypoglycemics cannot replace a healthy lifestyle and should be complemented by a nutritious diet, regular exercise, and blood glucose monitoring. The choice of oral hypoglycemic is influenced by various factors, including the patient's age, weight, renal function, and preferences. Adjustments to the dosage and frequency of oral hypoglycemic medications may be necessary over time to achieve optimal blood glucose control.[37]

Introduction to the COVID-19 pandemic

Emergence and Impact of the COVID-19 Pandemic: The COVID-19 pandemic, originating from a new coronavirus detected in China in late 2019, has evolved into a global health crisis, profoundly affecting social, economic, and individual aspects worldwide.[38] As of January 2024, the pandemic has led to approximately 300 million confirmed cases and 7 million fatalities globally, with severe repercussions on the global economy and supply chains. This has resulted in reduced incomes, increased poverty levels, and heightened concerns regarding food security. There has been growing pressure on healthcare professionals and systems, accompanied by challenges in accessing essential medical care and prescription medications.[38]

Lockdowns, isolation, and heightened stress levels have amplified substance misuse, domestic violence, and mental health issues. These measures have also disrupted educational, employment, and social support structures, particularly impacting vulnerable groups such as women, children, migrants, and informal laborers.[38]

General Effects of the Pandemic on Healthcare Systems and Vulnerable Populations: The worldwide consequences of the COVID-19 pandemic have been profound, especially for marginalized and vulnerable populations. In 90 percent of countries worldwide, the pandemic has caused disruptions to crucial health services, encompassing mental health, immunization, maternal and child health, and chronic disease care. Additionally, the pandemic has exposed the vulnerabilities and injustices within the food system, leading to increased food insecurity, malnutrition, and poverty, particularly affecting those residing in low- and middle-income nations. Individuals with underlying health issues such as diabetes, heart disease, cancer, and obesity face a higher risk of severe illness and mortality due to COVID-19 resulting from the pandemic. The impact of the epidemic has been disproportionately felt by Indigenous populations, who experience higher levels of socioeconomic deprivation, marginalization, discrimination, and limited access to essential services and healthcare. Additionally, many low-income and minority workers, constituting a significant portion of the essential workforce, struggle to adhere to preventive measures such as staying at home, practicing social distancing, and wearing masks. Consequently, their living and working conditions have worsened due to the ongoing pandemic.[39]

Intersection of COVID-19 and Diabetes COVID-19's impact on Patients with Diabetes

Individuals with diabetes, particularly those with uncontrolled diabetes, face a heightened risk of severe complications from COVID-19, such as blood clots, pneumonia, and organ failure. Managing diabetes becomes more difficult because COVID-19 can trigger fluctuations in blood sugar, stress reactions, and temporary insulin resistance. The pandemic has also affected the availability and affordability of insulin and other diabetic supplies, particularly for those who have lost their jobs or health insurance. To reduce their risk of virus exposure, individuals with diabetes should adhere to the precautionary recommendations from health authorities, including using masks, steering clear of social gatherings, and receiving vaccinations. Moreover, they should consistently keep track of their blood sugar levels, adhere to their diabetic treatment regimen, and promptly seek assistance if they encounter any symptoms of COVID-19 or other health issues.[40]

Reasons for Increased Susceptibility or Severity of covid-19 among diabetic individual[41,42,43]

Factors Leading to Higher Risk of Severe COVID-19 Outcomes in People with Diabetes	Explanation
1. Weakened Immune System	Diabetes weakens the immune system, making it harder for the body to fight off infections like COVID-19.
2. Chronic Inflammation	Diabetes involves chronic inflammation, exacerbating the body's response to viral infections, potentially leading to more severe symptoms.
3. Hyperglycemia (High Blood Sugar)	High blood sugar levels impair immune cell function, making it difficult for the body to combat infections effectively.
4. Co-existing Health Conditions	Individuals with diabetes often have other underlying health conditions (e.g., heart disease, obesity, hypertension) that increase the risk of severe COVID-19 outcomes.
5. Delayed Immune Response	Diabetes can affect the body's ability to mount a swift and effective immune response to infections, leading to longer recovery times and increased complications.
6. Blood Vessel and Organ Damage	Long-term diabetes can cause damage to blood vessels and organs, amplifying the risk of severe complications when infected with COVID-19.
7. Medication Effects	Some medications used to manage diabetes, like steroids or immune-suppressants, may weaken the immune system, increasing susceptibility to severe COVID-19 outcomes.

Rationale for the Study Need for study: Our study was driven by several compelling factors.

1) Public Health Significance: Diabetes is a global health concern with a steadily rising prevalence. The COVID-19 pandemic, which affected millions worldwide, posed significant risks to individuals with diabetes. Understanding how these two health crises intersected was crucial for public health management.
2) Risk Assessment: Those diagnosed with diabetes were recognized as a high-risk group for

severe COVID-19 outcomes. Investigating the incidence of diabetes in COVID-19 patients and their outcomes was essential for risk assessment and targeted interventions.

3) Healthcare Adaptation: The pandemic brought about shifts in healthcare practices, including the administration of COVID-19 vaccines and changes in prescription patterns for diabetes medications, as well as the influence of lab reports on patient management. Investigating how these healthcare adaptations impacted diabetes management and patient outcomes was crucial for optimizing healthcare strategies in future crises.
4) Treatment Efficacy: By examining prescription patterns, age, comorbidities, and lab reports, the study could shed light on the real-world effectiveness of existing diabetes treatments and their impact on patient outcomes.
5) Tailored Care: Understanding how prescription patterns aligned with patient characteristics could inform tailored diabetes care, ensuring that treatments were appropriate for diverse patient profiles and that the right care was provided to the right individuals.
6) Lessons for Future Pandemics: The research offered insights into healthcare system adaptability and preparedness for future health crises, enabling the formulation of evidence-based strategies to protect vulnerable populations.

Scarcity of Comparative Data: Comparative research faces challenges in terms of the accessibility and reliability of data, especially when addressing widespread occurrences like the COVID-19 pandemic. The global impact of epidemic has been substantial, particularly for people with long-term medical issues like diabetes, which poses a considerable risk for severe COVID-19 outcomes and subsequent complications. It is imperative to investigate the pandemic's effects on the outcomes and prevalence of diabetes in diverse nations, along with exploring the latest advancements and challenges in the management and prevention of the condition.[44]

Nevertheless, few thorough research papers or comparative data exist that explicitly examine the diabetes patients' prevalence rates and health consequences amidst the COVID-19 outbreak in contrast to non-pandemic times. Here are a few explanations for this scarcity: The COVID-19 global health crisis is currently ongoing, and there's not enough standardized and consistent data collection and reporting across various countries and regions. Discrepancies may arise due to variations in definitions, methods, and data sources related to COVID-19 cases, deaths, testing, vaccination, and comorbidities like diabetes. Additionally, data availability and accessibility may be hindered by delays, errors, or gaps in the reporting process.[44]

The COVID-19 pandemic is a complex and dynamic event with numerous interacting components across various levels, encompassing social, environmental, policy, and individual dimensions. Differentiating the pandemic's impact on those who have diabetes from external elements such as ethnicity, gender, age, socioeconomic status, health-related behaviors, healthcare systems, and governmental interventions can be intricate. Additionally, considering the diversity and heterogeneity among diabetes patients, along with variations in their environments such as treatment plans, comorbidities, complications, and diabetes type, duration, and severity, presents a significant challenge.[44]

Due to the unforeseen and unparalleled nature of the COVID-19 pandemic, innovative and novel methods and tools are essential for comparative research. The complexity and dynamic nature of the pandemic, especially its impact on diabetic patients, may surpass the capabilities of conventional methodologies and procedures. Collaborative and multidisciplinary research that integrates various data types—including quantitative and qualitative, primary and secondary, cross-sectional and longitudinal, aggregate and individual—is imperative. Moreover, more advanced and adaptable approaches and strategies, such as machine learning, causal inference, and network analysis, are needed. These methods can effectively process extensive and diverse datasets, identify patterns and connections, and generate insights and predictions.[44]

Literature Review

(Fadini et al., 2020)

The prevalence and consequences of diabetes in individuals affected with COVID-19 were investigated in this review. A quick systematic review of research revealing the diabetes frequency among individuals admitted with COVID-19 was carried out by the researchers. They discovered that the occurrence of diabetes was far greater than population averages in 20–50% of patients hospitalized with COVID-19, over numerous studies and nations. In comparison to those who do not have diabetes, those who do diabetes faced significantly increased chances of COVID-19- related severe symptoms and mortality. The proinflammatory state of diabetes, which results in too much cytokine immune responses, increased vulnerability to elevated inflammation and inability to breathe, increased rates for cardiac problems, and the impact of diabetes on immune response to the virus are some of the processes suggested by the authors as potential causes of this increased severeness. They draw the conclusion that there is a significantly increased risk of major problems and deaths when diabetes is present and interacts with COVID-19 infection.

(Kumar et al., 2020)

In order to ascertain if diabetes is linked to higher COVID-19 death and severeness, this study performed a meta-analysis. The frequency of diabetes and associated results in COVID-19 participants were reported in observational studies that the writers found through an extensive investigation of databases. According to a combined statistical analysis of ten trials including over 2,800 patients, diabetes was present in one-third of COVID-19 fatalities. In comparison to individuals without diabetes, individuals with diabetes had a nearly threefold elevated danger of septicemia, intensive care, acute respiratory distress syndrome (ARDS), and fatality. The authors propose that diabetes affects immunology, swelling, coagulation, and viral cell entry routes, all of which increase the severity of COVID-19. These findings show that diabetes is a strong predictive threat for adverse consequences with COVID-19, particularly when it is not adequately managed.

(Li et al., 2020)

This study looked at the frequency and impact of previously present metabolic ailments, such as diabetes, in Chinese patients with COVID-19. More than 1,500 confirmed COVID-19 patients' data from several hospitals in China have been investigated by investigators. They discovered that at least one metabolic disorder affected about 20% of individuals, with diabetes having the highest prevalence at about 9%. In comparison to patients with no metabolic disorders, individuals with any initial disorder were older, suffered from more symptoms like fever and breathlessness, higher rates of problems like sepsis and shock, required ventilation devices more frequently, spent more time in the hospital, and had much greater risks of death and needing critical care. The findings demonstrate how metabolic disorders such as diabetes and obesity can exacerbate the seriousness and impact of COVID-19. If those individuals are infected, the authors advise classifying them as those at greatest risk and safeguarding them.

(Guo et al., 2020)

This study looked back at how diabetes affected the outcome and course of COVID-19, notably the chance of fatality. Nearly 20% of the 174 verified COVID-19 hospitalized individuals in China whose data the researchers examined had diabetes. Diabetes turns out to be linked to an elevated incidence of fever, coughing, exhaustion, shortness of breath, problems such as sepsis, a greater necessity for mechanical ventilation, an extended duration of ventilation use, an extended hospital stay, an increased probability of needing critical care, and a 3.5 times higher risk of death. According to these results, diabetes is a significant risk factor that affects the severity and prognosis of COVID-19. Diabetes may be associated with increased COVID-19 severity through a number of pathways, including as impaired cell-mediated immunity, long-term swelling, hypercoagulation, cardiovascular disorder, and multiorgan injury. According to investigators Improving glycemic management and avoiding diabetes-related problems should lead to a better prognosis for COVID-19 patients.

(Singh et al., 2020)

The most recent research on the prevalence of diabetes in COVID-19 patients and its effects on COVID-19 results is reviewed in this publication. According to research summarised by the authors, about 20 percent of patients hospitalized with COVID-19 have diabetes, which is significantly greater than the prevalence of diabetes in the general community. Numerous investigations prove diabetes, especially when improperly managed worsens COVID-19 seriousness and death risk. The proinflammatory state of diabetes, immunosuppression, vascular failure, and multiorgan injury from complications resulting from diabetes are among the hypothesised processes. They propose that the cytokine storm reaction that drives the course of severe COVID-19 is similar to the decompensation of diabetic ketoacidosis. To improve COVID-19 results, adequate control of glucose and diabetes care are essential. Lockdowns, however, make it difficult to preserve access to the outpatient section. The authors offer helpful suggestions for treating people who have COVID-19 and diabetes.

(Hartmann et al., 2020)

This study reviews the data on results, hazards, and treatment concerns as it looks at the relationship between diabetes and COVID-19. The authors note studies that demonstrate a substantial increase in serious illness and mortality in diabetes groups across research, along with a high diabetes incidence of 20–50% among hospitalized COVID-19 patients. The immune system's malfunction, swelling, damaged blood vessels, and organ damage associated with diabetes are among the hypothesized processes. Lessons from previous coronavirus epidemics, such as SARS and MERS, also showed that diabetes comorbidity had a worse result. The authors investigate how lockdowns, clinic closures, and concerns about infection exposure could impede access to healthcare due to COVID-19. Vigilant blood glucose monitoring is also required during COVID-19 hospitalization because to acute metabolic disturbance. Given the compound illness burden of ongoing diabetes and COVID-19, they offer advice for public understanding, patient education, preserving critical services, infection protection, controlling medications, and managing psychological concerns.

Lacunae in Literature

Lacunae in Literature Review	Explanation
Limited Comparative Studies	Existing literature lacks comprehensive comparative analyses of diabetes patient prevalence and outcomes during COVID-19 across diverse regions or populations.
Insufficient Data on Current Trends	The available literature does not adequately cover recent trends in diabetes management, the impact of COVID-19, and evolving treatment strategies during the ongoing pandemic.
Variability in Reported Outcomes	Conflicting or inconclusive outcomes regarding COVID-19 prevalence in diabetic patients create a lack of consensus due to varying methodologies and sample sizes in different studies.
Limited Focus on Diverse Patient Profiles	The literature does not sufficiently explore how demographic factors like age, gender, socioeconomic status, or comorbidities influence COVID-19 outcomes among diabetic patients across different groups.
Scope for Longitudinal Studies	There is a lack of longitudinal studies tracking the progression of COVID-19 among diabetic patients over time, hindering a comprehensive understanding of evolving trends and outcomes.

AIMS AND OBJECTIVES

Aim: To investigate and compare the prevalence of diabetes and its outcomes amidst the COVID-19 pandemic and current trends, with a focus on patient outcomes, prescription patterns, age, gender, lab reports, and healthcare settings, for the purpose of providing valuable understanding on the effects of the pandemic on individuals with diabetes and the evolving healthcare landscape.

Objectives

1) To Examine Prescription Patterns: Exploring current trends in prescription patterns for diabetes medications and assess their alignment with features of the patient, providing information about the adaptation of healthcare during the global health crisis.
2) To Assess the Relationship Between Lab Reports and Patient Outcomes: Examining how lab reports, including blood glucose levels and other relevant indicators, correlate with the severity of COVID-19 outcomes in diabetic patients.
3) To Investigate the Relationship between COVID-19 Patient Status: Exploring whether diabetic patients who contract COVID-19 and are treated in different healthcare settings (e.g., general wards, ICUs, specialized departments) experience distinct outcomes and prescription patterns.

METHODOLOGY

Study site: The study was conducted at Mythri Hospital Mehdipatnam, Hyderabad, Telangana State, India.

Study design: Retrospective and Prospective Comparative Analysis. This research employed a dual-method approach, combining both retrospective and prospective comparative analyses to comprehensively investigate the COVID-19 pandemic's effects on diabetes patients and explore current trends in their management. The retrospective component involved the examination of historical data, spanning the pandemic period, to assess the prevalence and outcomes of COVID-19 among individuals with and without diabetes. Simultaneously, the prospective aspect involved the ongoing collection of data to capture current trends in diabetes care. This combined design enabled a thorough comprehension of the dynamic relationship between diabetes, the evolving landscape related to the COVID-19 pandemic, and contemporary healthcare practices.

Study Duration: The research was carried out for a period of six months from July 2023 to January 2024.

Sample size: The study involved a total sample size of 668 participants. Among them, 334 participants were included retrospectively, focusing on individuals with diabetes and COVID-19. The remaining 334 participants were enrolled prospectively, representing individuals without COVID-19.

Ethical consideration: The research was conducted involving the approval of the Institutional Ethics Committee. (ECR/1169/Inst/TG/2018)

Study procedure

Data collection: Data will be reviewed and extracted from medical records and databases, with a focus on ensuring data accuracy and completeness.

Sources of data: Medical records of diabetes patients, encompassing information about diabetes diagnosis, treatment, comorbidities, COVID-19 testing or diagnosis, and other relevant health data. Access to the Medical Records Database (MRD) was integral to the comprehensive examination of patient records.

Selection criteria

a) **Inclusion criteria:** Diabetes Diagnosis: Individuals with a confirmed diagnosis of diabetes, including both individuals with type 1 and type 2 diabetes.

Age Range: Individuals of every age group, encompassing kids, teens, and adults. Sex: Both the sexes, males and females, were included.

Patients with comorbidities

b) **Exclusion criteria:** Gestational Diabetes: Individuals with a current or historical diagnosis of gestational diabetes. Severe Cognitive Impairment: Individuals with significant cognitive impairment that might impede their ability to provide informed consent or participate effectively.

Inadequate Data: Patients for whom comprehensive medical records and relevant data, including diabetes status, comorbidities, and COVID-19 testing or diagnosis records, are not available or incomplete.

Individuals without diabetes

Statistical analysis: IBM SPSS version 24 facilitated the statistical analysis, continuous and discrete variables expressed as Mean ± Standard Deviation and frequency with percentage (N), respectively. For normal distribution/scale data, the standard deviation and mean were used, and in the case of categorical data, frequency with proportion N (%) was reported. To test different groups among variables in different categories, the analysis employed the t-test. Statistical analyses were carried out for all data at a 5% significance level or 95% confidence interval, considering a P-value less than 0.05 as statistically significant.

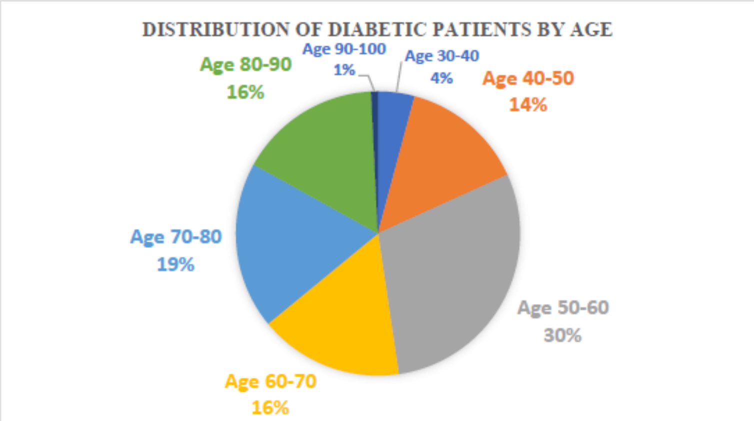
RESULTS

Prospective results

- Sample Size: 668
- Software used: SPSS version 24

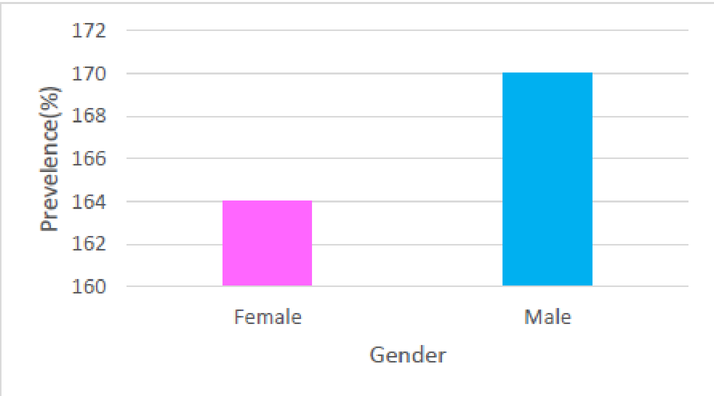
*It is noteworthy that all patients in the study are classified as diabetic. However, it appears that diligent medication adherence and lifestyle changes have resulted in a decrease in blood sugar levels for certain individuals, placing them within the prediabetes and normal category. This suggests a dynamic and potentially positive response to therapeutic interventions, emphasizing the significance of proactive health management in diabetes care within the study population.

Age Prevalence



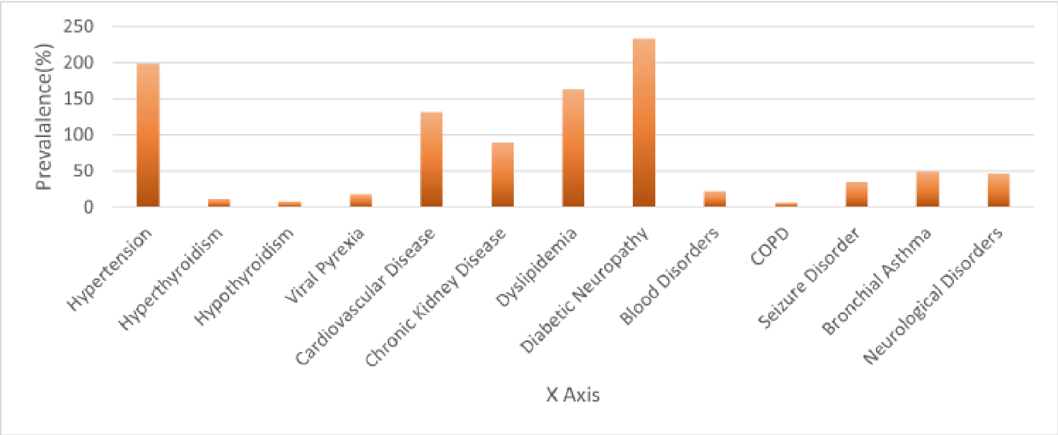
The distribution suggests an increasing trend in the number of diabetic patients with age until the 70-80 age group. The highest number of diabetic patients is in the 50-60 age group, with 113 patients. The 90-100 age group has a very small number of diabetic patients (3 patients).

Gender Prevalence

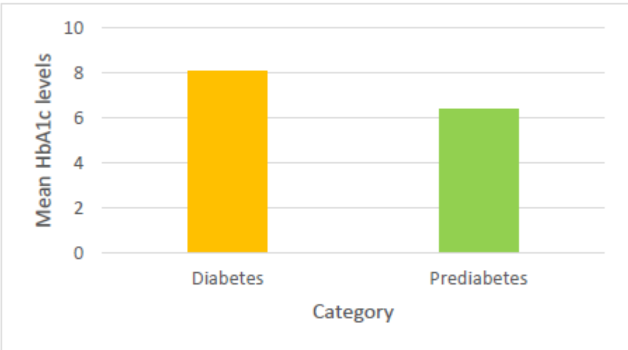


The prospective study encompasses a total of 334 participants, with 164 females, indicating 49.1% of the overall sample. The male cohort consists of 170 participants, making up 50.9% of the total study population, highlighting a slightly higher representation of males in the dataset.

Prevalence of comorbid conditions: In the studied population of diabetic patients, hypertension emerges as highly prevalent, affecting 198 individuals, emphasizing its significance as a major risk factor for cardiovascular events. Notably, cardiovascular disease is present in 131 patients, underscoring the substantial burden of heart-related conditions. Dyslipidemia is widespread, observed in 163 patients, highlighting the need for effective management to prevent cardiovascular events. Diabetic neuropathy, affecting 234 patients, emphasizes the necessity for comprehensive diabetes care, including neuropathy screening. Chronic kidney disease is identified in 89 patients, emphasizing the importance of renal function monitoring, especially in association with conditions like hypertension and diabetes. The relatively smaller subsets with hyperthyroidism, hypothyroidism, blood disorders, COPD, seizure disorder, bronchial asthma, and various neurological disorders indicate specific health challenges within the diabetic population, necessitating targeted care and monitoring. Further investigation into viral pyrexia and its specific causes may provide insights into the infectious history of the cohort.

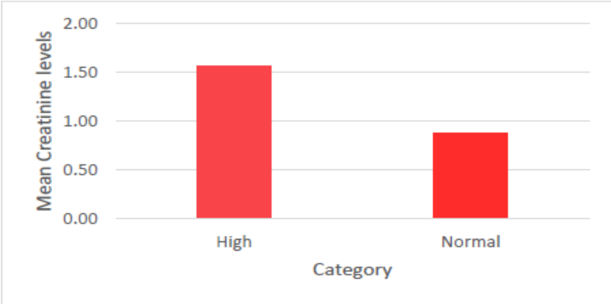


Mean HbA1c levels: The predominant HbA1c levels among the patients in the study fall within the range of 6.4% to 9.7%, with the most prevalent levels observed between 6.5% and 9.5%. This suggests that a substantial majority of the patient population exhibits glycated hemoglobin levels within this specific range, indicating a notable prevalence of moderate to elevated levels of long-term blood glucose.



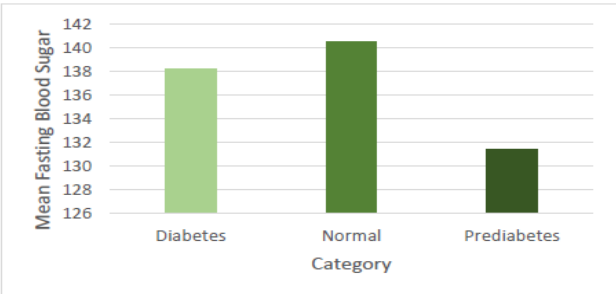
The study reveals that most patients (97.9%) are categorized as having diabetes based on their HbA1c levels. Remarkably, a smaller proportion (2.1%) falls within the prediabetes category.

Mean Creatinine Levels



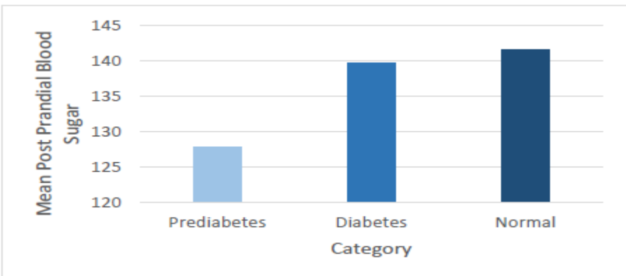
The study assesses creatinine levels in two categories: "High" (0.6 mg/dL to 1.8 mg/dL) and "Normal" (0.6 mg/dL to 1.8 mg/dL). Notably, the majority of patients exhibit high creatinine levels, as indicated by the comprehensive breakdown of frequency distribution and percentages within the "High" category.

Mean Fasting Blood Sugar Levels: The diabetes categorization based on fasting blood sugar levels reveals distinct patterns within the study population. Approximately 44.3% of the participants, totaling 148 patients, are classified under the "Diabetes" category, indicating a noteworthy prevalence of increased levels of fasting blood sugar consistent with diabetes.



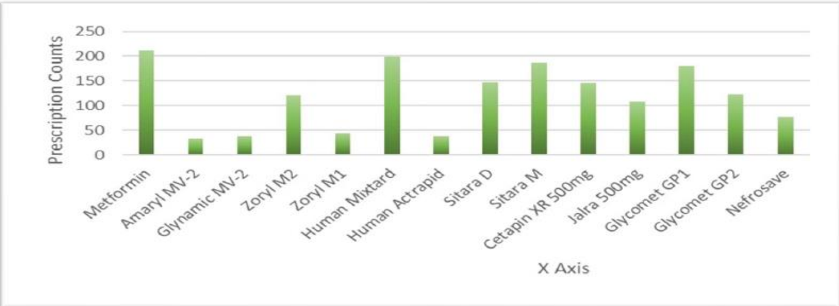
Conversely, 53.6% of the individuals, accounting for 179 patients, fall into the "Normal" category, signifying blood sugar levels within the normal range. A smaller proportion, 2.1%, comprising 7 patients, falls into the "Prediabetes" category.

Mean Postprandial Blood Sugar Levels



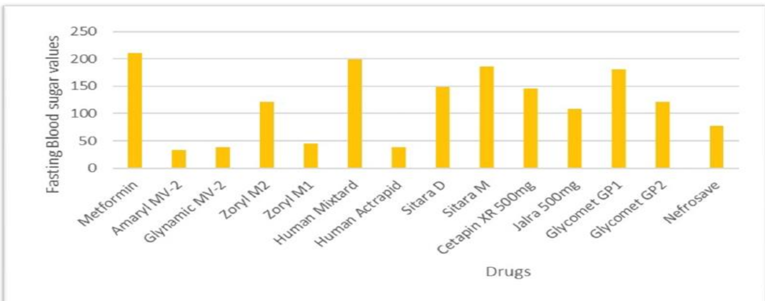
The categorization of individuals based on postprandial blood sugar levels unveils distinct trends in the study cohort. Within the "Diabetes" category, 32.6% of participants, totaling 109 patients, exhibit elevated postprandial blood sugar levels indicative of diabetes. This underscores a notable prevalence of diabetes in the studied population. Contrarily, 56.0% of individuals, accounting for 187 patients, fall into the "Normal" category, signifying postprandial blood sugar levels within the normal range. A smaller subset, 11.4%, comprising 38 patients, falls into the "Prediabetes" category.

Prescription Counts for Different Drugs



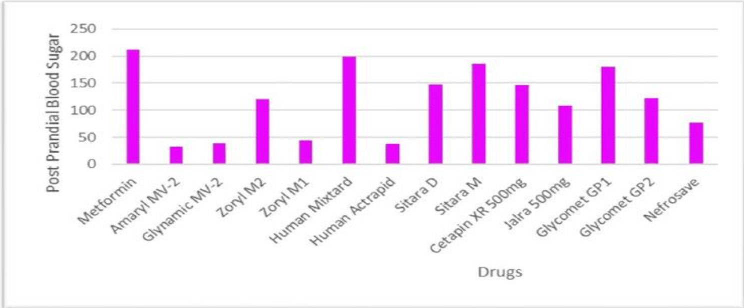
In the medication prescription analysis, several noteworthy patterns emerge. Metformin, Human Mixtard, and Sitara M stand out as the most commonly prescribed drugs among the listed drugs, implying their widespread utilization in the treatment of diabetes within the studied population. Incorporating insulin formulations, Human Mixtard and Human Actrapid, suggests that a considerable number of patients might need to take insulin to achieve optimal glycemic control. Additionally, a range of oral hypoglycemic drugs, like Metformin, Amaryl MV-2, Glynamic MV- 2, Zoryl M2, Zoryl M1, Sitara D, Sitara M, Cetapin XR 500mg, Jalra 500mg, Glycomet GP1, and Glycomet GP2, is commonly prescribed to regulate blood sugar levels. Notably, Glycomet GP1, Glycomet GP2, Sitara M, Sitara D, Zoryl M2, Zoryl M1, Glynamic MV-2 and Amaryl MV-2 are identified as combination medications, implying the potential necessity for dual therapy in some patients.

Relationship between the fasting blood sugar and prescribed drugs



Fasting Blood Sugar Range	Prescription
100-125 mg/dL	Metformin
126-200 mg/dL	Metformin + One from ['Amaryl MV-2', 'Glynamic MV-2', 'Zoryl M2', 'Zoryl M1']
200-300 mg/dL	One from ['Human Mixtard', 'Human Actrapid'] + Metformin + One from ['Amaryl MV-2', 'Glynamic MV-2', 'Zoryl M2', 'Zoryl M1']
50-99 mg/dL	Metformin

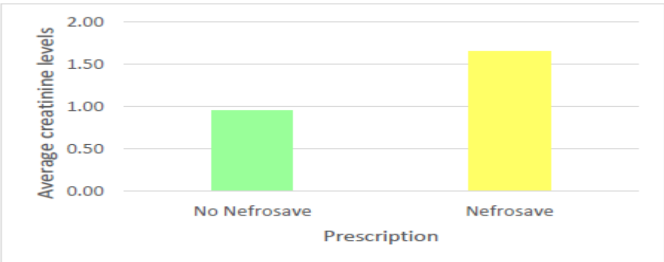
Relationship between post prandial blood sugar and prescribed drugs



Post-Prandial Blood Sugar Range	Prescription
140-199 mg/dL	Metformin
200-400 mg/dL	Metformin + One from ['Amaryl MV-2', 'Glynamic MV-2', 'Zoryl M2', 'Zoryl M1'] + One from ['Human Mixtard', 'Human Actrapid']
200-400 mg/dL	One from ['Human Mixtard', 'Human Actrapid'] + Metformin + One from ['Amaryl MV-2', 'Glynamic MV-2', 'Zoryl M2', 'Zoryl M1'] + One from ['Sitara D', 'Sitara M', 'Citapin XR 500mg', 'Jalra 500mg', 'Glycomet GP1', 'Glycomet GP2']
50-139 mg/dL	Metformin

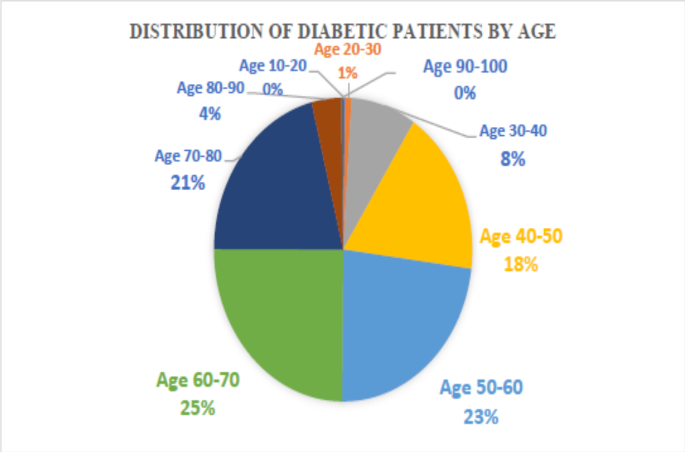
Suggests a tiered approach to medication prescription, with Metformin being a common denominator across all ranges. Additional medications are added based on the severity of blood sugar levels, providing a tailored strategy for managing diabetes.

Relationship between creatinine prescription and Nefrosave drug: The graph interpretation reveals that patients with creatinine levels starting from 0.6 mg/dL and higher were prescribed Nefrosave. This suggests a targeted therapeutic approach, possibly aimed at maintaining or improving renal function in individuals with varying degrees of renal health within this specified creatinine range.



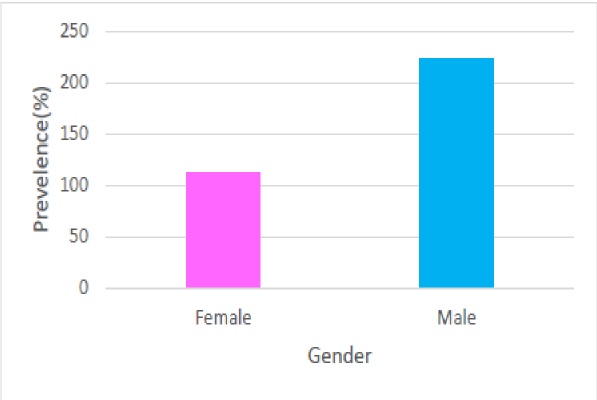
Retrospective results

Age Prevalence



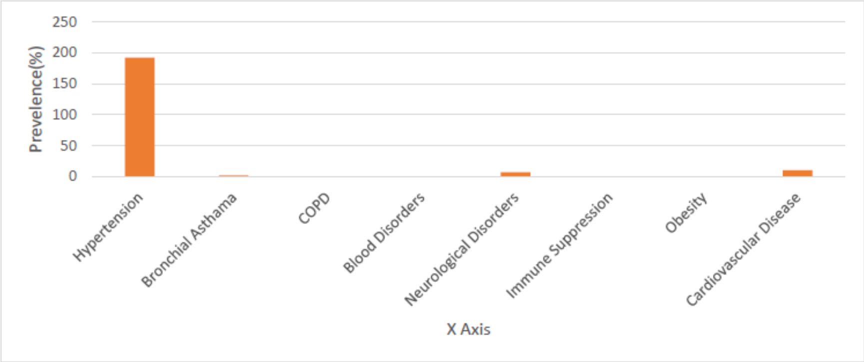
Graph observations indicate a notable concentration of diabetic patients within the age ranges of 40-80, with prominent peaks in the 50-60 and 60-70 age groups. There is a discernible decrease in the number of diabetic patients in age groups below 40 and above 80. Important ideas extracted from the distribution patterns highlight an overall increase in diabetes occurrence increasing with age, along with the highest number of diabetic patients observed in the 60-70 age group, closely followed by the 50-60 and 70-80 age groups.

Gender Prevalence



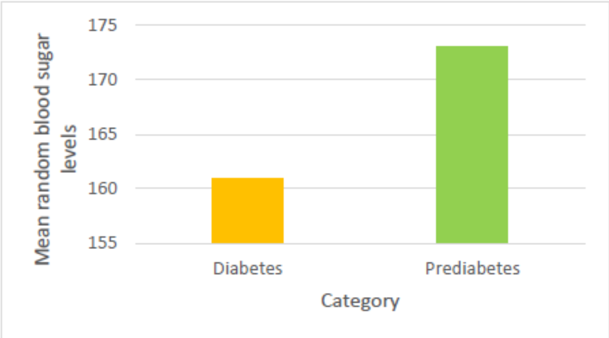
The graph observations highlight a significant gender distribution among diabetic patients in this dataset, with males constituting the majority at 66.5% constituting the majority, with females making up 33.5%. Significant findings extracted from these observations underscore a notable gender imbalance, emphasizing a higher proportion of male diabetic patients in comparison to females. This gender disparity is crucial as gender differences can play a significant role in influencing the risk, progression, and management of diabetes.

Prevalence of Comorbid Conditions



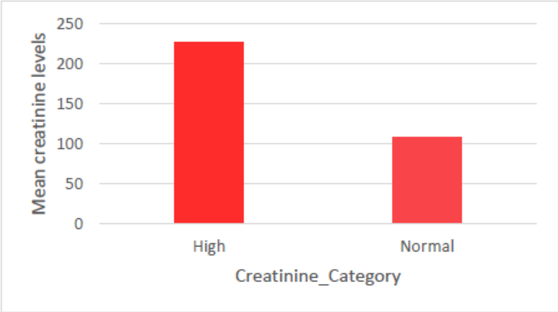
The graph interpretation highlights that hypertension stands out as the most prevalent comorbidity among diabetic patients, with 192 individuals having this condition. Conversely, there are notably fewer patients with comorbidities such as Bronchial Asthma, Neurological Disorders, and cardiovascular disease. Strikingly, no patients have reported comorbidities related to COPD, Blood Disorders, Immune Suppression, or Obesity. Important conclusions drawn from these observations emphasize the common co-occurrence of hypertension among diabetic patients, aligning with the well-established association between diabetes and hypertension. The absence of reported cases for certain comorbidities may suggest a lower prevalence of those conditions within this diabetic population.

Average random blood sugar levels



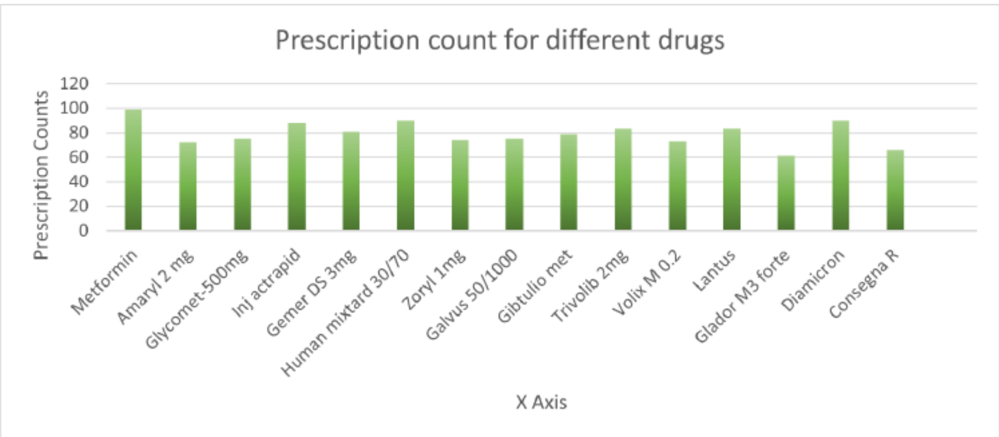
The graph interpretation provides insights into the distribution of blood glucose levels categories among patients. Approximately 48.2% of individuals have received a diagnosis of diabetes, while the remaining 51.8% fall into the prediabetes category. It is noteworthy to mention that all patients in the study were initially classified as diabetic. However, the findings reveal a dynamic response to therapeutic interventions, with some individuals experiencing a reduction in blood sugar levels, subsequently placing them within the prediabetes category.

Mean creatinine levels

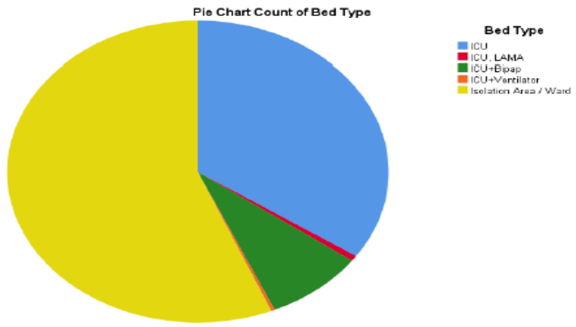


The graph interpretation highlights the distribution of creatinine categories among patients, revealing that 68.0% of individuals have high creatinine levels, while 32.0% fall into the normal creatinine category. The majority of patients exhibiting high creatinine levels may indicate potential impaired kidney function.

Prescription Counts for Different Drugs: The graph interpretation illustrates the prescription counts for various medications within the study, revealing noteworthy patterns. Diamicron emerges as the most frequently prescribed medication with a count of 90, closely followed by Human Mixtard 30/70 also at 90, and Metformin leading with 99 prescriptions. On the other hand, Glador M3 Forte exhibits the lowest prescription count at 61. These findings emphasize the prescribing preferences within the studied population, with Diamicron, Human Mixtard 30/70, and Metformin being the most commonly prescribed medications. The lower prescription count for Glador M3 Forte suggests its comparatively lesser utilization within the cohort. Notably, Gemer DS 3mg, Human mixtard 30/70, Galvus 50/1000, Gibtulio met, Trivolib 2mg, Volix M 0.2, Glador M3 forte, Consegna R are identified as combination medications, implying the potential necessity for dual therapy in some patients.

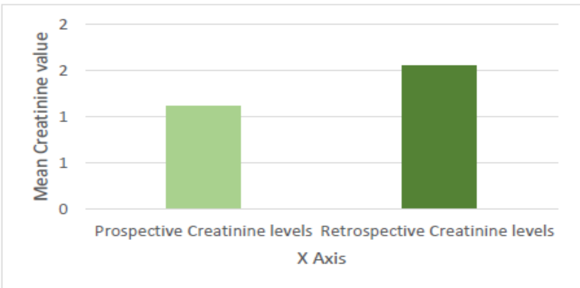


Bed Type



The distribution of patients based on bed types revealed distinct patterns in healthcare utilization. A significant proportion, constituting 56.3% of the total, occupied the Isolation Area or Ward, highlighting the predominant use of these facilities. Intensive Care Unit (ICU) beds accommodated 34.4% of patients, signifying a substantial but distinct subset of the hospitalized population. Within the ICU, a minority of patients opted for Leave Against Medical Advice (LAMA) (0.6%), while others required additional respiratory support, with 8.4% receiving Bi-level Positive Airway Pressure (Bipap) and 0.3% being assisted by a ventilator.

Comparison of mean creatinine values in prospective and retrospective data



The prospective study, involving 334 patients, showed that around 34.7% had elevated creatinine levels. In contrast, the retrospective study, with the same number of patients, demonstrated a notably higher prevalence of approximately 67.8%.

Paired t-test

Statistics for Paired Samples					
		Mean	**N**	**Std. Deviation**	**Standard Error of the Mean**
Pair 1	Age	64.0838	334	13.53004	.74033
	Age (years) retrospective	59.0329	334	13.48123	.73766
Pair 2	Hypertension prospective	.59	334	.492	.027

	Hypertension retrospective	.58	334	.494	.027
Pair 3	Bronchial Asthma prospective	.15	334	.354	.019
	Bronchial Asthma retrospective	.01	334	.094	.005
Pair 4	Blood Disorders prospective	.06	334	.243	.013
	Blood Disorders retrospective	.00	334	.000	.000
Pair 5	COPD prospective	.02	334	.133	.007
	COPD retrospective	.00	334	.000	.000
Pair 6	Cardiovascular Disease prospective	.39	324	.489	.027
	Cardiovascular Disease retrospective	.03	324	.173	.010
Pair 7	Creatinine_Category prospective	.	0[a]	.	.
	Creatinine levels retrospective	.	0[a]	.	.
Pair 8	Metformin prospective	.63	334	.483	.026
	Metformin retrospective	.30	334	.459	.025
Pair 9	Amaryl MV-2prospective	.10	334	.299	.016
	Amaryl 2 mg retrospective	.22	334	.412	.023
Pair 10	Glynamic MV-2prospective	.12	334	.322	.018
	Glycomet-500mg retrospective	.22	334	.418	.023
Pair 11	Zoryl M1prospective	.20	334	.403	.022
	Zoryl 1mg retrospective	.22	334	.416	.023

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Age & Age (years)retrospective	334	.109	.047
Pair 2	Hypertension prospective & Hypertension retrospective	334	.012	.823
Pair 3	Bronchial Asthma prospective & Bronchial Asthma retrospective	334	.140	.010
Pair 4	Blood Disorders prospective & Blood Disorders retrospective	334	.	.
Pair 5	COPD prospective & COPD retrospective	334	.	.
Pair 6	Cardiovascular Disease prospective & Cardiovascular Disease retrospective	324	.039	.479
Pair 8	Metformin prospective & Metformin retrospective	334	-.029	.592
Pair 9	Amaryl MV-2prospective & Amaryl 2 mg retrospective	334	-.003	.960
Pair 10	Glynamic MV-2prospective & Glycomet-500mgretrospective	334	.095	.084
Pair 11	Zoryl M1prospective & Zoryl 1mg retrospective	334	.017	.761

Statistics for Paired Samples

		Differences in Pairs					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Standard Error of the Mean	95% Confidence Interval for the Difference				
					Lower	Upper			
Pair 1	Age - Age (years)retrospective	5.05090	18.02918	.98651	3.11032	6.99148	5.120	333	.000
Pair 2	Hypertension prospective– Hypertension retrospective	.012	.693	.038	-.063	.087	.316	333	.752
Pair 3	Bronchial Asthma prospective - Bronchial Asthma sretrospective	.138	.354	.019	.100	.176	7.116	333	.000
Pair 4	Blood Disorders prospective - Blood Disorders retrospective	.063	.243	.013	.037	.089	4.727	333	.000
Pair 5	COPD prospective – COPD retrospective	.018	.133	.007	.004	.032	2.468	333	.014

Pair 6	Cardiovascular Disease prospective - Cardiovascular Disease retrospective	.361	.512	.028	.305	.417	12.690	323	.000
Pair 8	Metformin prospective – Metformin retrospective	.332	.676	.037	.260	.405	8.987	333	.000
Pair 9	Amaryl MV- 2prospective - Amaryl 2 mg retrospective	.117	.510	.028	-.172	-.062	- 4.188	333	.000
Pair 10	Glynamic MV- 2prospective - Glycomet-500mgretrospective	.108	.503	.028	-.162	-.054	- 3.919	333	.000
Pair 11	Zoryl M1prospective - Zoryl 1mgretrospective	.018	.574	.031	-.080	.044	- .572	333	.568

Significant Correlation Matrix

1. Age

- The mean age in the prospective group is significantly higher than in the retrospective group (mean difference = 5.05 years, $p < 0.001$). This suggests that individuals in the prospective group tend to be older compared to their retrospective counterparts.

2. Bronchial Asthma

- The prospective group has a significantly higher prevalence of bronchial asthma compared to the retrospective group (mean difference = 0.138, $p < 0.001$). This implies a higher incidence of bronchial asthma in the prospective data.

3. Blood Disorders

- Individuals in the prospective group have a significantly higher prevalence of blood disorders compared to the retrospective group (mean difference = 0.063, $p < 0.001$). This indicates an increased occurrence of blood disorders in the prospective data.

4. COPD

- The prospective group shows a significantly higher prevalence of COPD (stands for chronic obstructive pulmonary disease) compared to the retrospective group (mean difference = 0.018, $p = 0.014$). This suggests an elevated incidence of COPD in the prospective data.

5. Cardiovascular Disease

- The prevalence of cardiovascular disease is significantly higher in the prospective group compared to the retrospective group (mean difference = 0.361, $p < 0.001$). This indicates a greater occurrence of cardiovascular disease in the prospective data.

6. Metformin

- The use of Metformin is significantly higher in the prospective group compared to the retrospective group (mean difference = 0.332, $p < 0.001$). This implies a greater utilization of Metformin in the prospective data.

7. Amaryl MV-2

- The use of Amaryl MV-2 is significantly lower in the prospective group compared to the retrospective group (mean difference = -0.117, $p < 0.001$). This suggests a reduced usage of Amaryl MV-2 in the prospective data.

8. Glynamic MV-2

- The use of Glynamic MV-2 is significantly lower in the prospective group compared to the retrospective group (mean difference = -0.108, $p < 0.001$). This implies a decreased utilization of Glynamic MV-2 in the prospective data.

Metric	**Retrospective (COVID-era)**	**Prospective (post-COVID era)**
Age Distribution	Highest prevalence in 50-70 years age group, decreasing after 80 years	Increasing prevalence with age until 70-80 years, highest in 50-60 years, very few above 90 years
Gender Distribution	Majority males (66.5%), females only 33.5%s	Males (50.9%) slightly higher than females (49.1%), more balanced
Comorbid Conditions	Hypertension most prevalent (192 patients), few with asthma, neurological disorders, CVD	Hypertension highly prevalent (198 patients), followed by CVD (131) and dyslipidemia (163). Diabetic neuropathy prevalent (234 patients)
Blood Sugar Levels	48.2% diabetes, 51.8% prediabetes	97.9% diabetes, 2.1% prediabetes based on HbA1c
Creatinine Levels	68% high, 32% normal	Majority high creatinine
Medication Use	Diamicron, Human Mixtard, Metformin most prescribed	Metformin, Human Mixtard, Sitara M most prescribed
Healthcare Utilization	56.3% regular ward, 34.4% ICU, 8.4% Bipap, 0.3% ventilator	Prospective study based in OPD setting

Key Takeaways

- Gender distribution became more balanced in post-COVID era.
- More comorbid conditions reported in prospective study.
- Metformin remained commonly prescribed in both studies.
- Prospective study provided view of outpatient management versus retrospective study's inpatient focus during COVID.

DISCUSSION

In our investigative endeavor, we delved into a thorough examination of diverse parameters, including lab reports, comorbidities, age, gender, and medications, aiming to draw insightful comparisons between two distinct patient cohorts. Specifically, our retrospective arm scrutinized the profiles of individuals concurrently diagnosed with COVID-19 and diabetes, while the prospective segment centered solely on those managing diabetes. Noteworthy disparities emerged across various dimensions, elucidating the complex interplay between infectious and chronic diseases. Age and comorbidities surfaced as pivotal determinants, revealing nuanced patterns in both cohorts. The comparative analysis of medication regimens underscored the dynamic nature of treatment strategies, particularly in the context of dual health challenges. This research not only offers a comprehensive understanding of the diverse clinical landscapes but also furnishes valuable insights for optimizing healthcare approaches tailored to the unique needs of patients grappling with the intricate intersection of COVID-19 and diabetes.

The differences in age prevalence between the retrospective and prospective studies may be attributed to the unique circumstances of the COVID era. The retrospective study captures the dynamics during the peak of the pandemic, whereas the prospective study includes patients from the post-COVID era. The shift in the highest prevalence age group from 60-70 in the retrospective to 50-60 in the prospective study may indicate evolving patterns in diabetes prevalence and demographic changes influenced by the pandemic. Further analysis and exploration are warranted to understand the impact of COVID on diabetes demographics and the healthcare landscape.

The shift from a significant gender imbalance in the retrospective study to a more balanced representation in the prospective study suggests potential changes in gender dynamics related to diabetes post-COVID. Factors such as healthcare access, awareness, and demographic shifts during and after the pandemic could contribute to these differences. Recognizing and understanding these alterations are crucial for tailoring strategies for managing diabetes to the evolving needs of both sexes diabetic populations. Further analysis and exploration are needed to delve deeper into the underlying factors influencing gender representation in diabetes demographics.

The comparative analysis of the retrospective (COVID era) and prospective (post-COVID era) studies unveils notable trends and shifts within the diabetic patient population. Hypertension remains consistently prevalent in both periods, emphasizing its enduring association with diabetes.

Cardiovascular disease burden persists, though the prospective study indicates a continued significant impact with 131 affected patients. Dyslipidemia is widespread in both studies, underscoring the ongoing requirement for efficient lipid control to mitigate cardiovascular risks. Diabetic neuropathy and long-term kidney dysfunction remain high priorities, with 234 patients exhibiting neuropathy in the prospective study and 89 patients identified with chronic kidney disease. The prospective study introduces variability in comorbidities, including smaller subsets with hyperthyroidism, hypothyroidism, blood disorders, COPD, seizure disorder, bronchial asthma, and various neurological disorders, suggesting evolving health complexities. The absence of reported cases for certain comorbidities in the retrospective study, such as COPD, blood disorders, immune suppression, and obesity, may indicate shifts or variations in the prevalence of these conditions in the post-COVID era. Overall, the comparative analysis highlights the enduring significance of certain comorbidities, the emergence of new health complexities, and potential changes in prevalence trends within the diabetic patient population over time.

The retrospective study conducted during the COVID-19 era unveils distinct prescription trends in diabetes management, emphasizing the challenges posed by the pandemic. Metformin, Diamicron, and Human Mixtard take center stage, potentially reflecting a strategic emphasis on medications conducive to remote management and reduced healthcare facility reliance during lockdowns. The prevalence of insulin formulations, particularly Human Mixtard and Human Actrapid, underscores the heightened need for insulin therapy, possibly driven by disruptions in regular healthcare access. The recognition of combination medications, like Glycomet GP1, Glycomet GP2, Sitara M, and Sitara D, suggests a comprehensive therapeutic approach with a potential for dual therapy to address complex patient needs during a challenging period. Transitioning to the prospective study post-COVID-19, the landscape has likely evolved. While Metformin retains its prominence with 99 prescriptions, the inclusion of Amaryl MV-2, Glynamic MV-2, Zoryl M2, Zoryl M1, Cetapin XR 500mg, Jalra 500mg, and Trivolib 2mg in the list of oral antidiabetic agents implies a more diversified approach in the post-pandemic era. This broader range of prescribed medications signifies an adaptation to a normalized healthcare environment, possibly providing additional choices for personalized diabetes management strategies. The consistent identification of combination medications reaffirms the continued need for flexible and multifaceted approaches in diabetes care beyond the pandemic, ensuring optimal glycemic control for diverse patient populations.

In the prospective study conducted in the post-COVID era, a comprehensive approach to diabetes monitoring is evident through incorporating crucial lab values such as postprandial blood glucose, fasting glucose, and HbA1c. This expanded set of laboratory parameters reflects an evolved and thorough assessment strategy, possibly influenced by advancements in healthcare practices or the recognition of the importance of detailed glycemic control in the aftermath of the COVID-19 pandemic. The inclusion of postprandial and fasting blood sugar values allows for a more nuanced understanding of daily glucose fluctuations, offering insights into immediate and sustained glycemic responses. Furthermore, the incorporation of HbA1c, a marker of long-term glucose control, adds a valuable dimension to the assessment, enabling a holistic evaluation of diabetes management effectiveness. In contrast, the retrospective study from the COVID-19 era relies solely on random blood sugar levels, indicative of the challenges and limitations posed by the pandemic, potentially leading to simplified monitoring approaches during that period. Acknowledging these differences in glycemic assessment methods in the respective studies is crucial for contextualizing the variations in data collection practices and understanding the impact of evolving healthcare paradigms on diabetes care.

The comparison between the prospective study conducted in the post-COVID era and the retrospective study from the COVID-19 era reveals significant disparities in the prevalence of elevated creatinine levels among diabetic patients. In the prospective study, 116 out of 334 patients (approximately 34.7%) exhibited high creatinine levels, suggesting a relatively lower prevalence during the post-COVID era. Conversely, the retrospective study portrays a notable increase in the prevalence of elevated creatinine levels, with 227 out of 334 patients (approximately 67.8%) affected during the COVID-19 era. This substantial difference, highlighting a more than twofold increase in the retrospective study, underscores the potential impact of the COVID-19 pandemic on renal health within the diabetic population. The elevated prevalence observed retrospectively may be indicative of heightened stress on healthcare systems, limited access to medical facilities, or disruptions in routine healthcare during the pandemic. This comparison emphasizes the importance of understanding temporal variations in health outcomes and underscores the need for targeted interventions to address renal health concerns among diabetic individuals, particularly during challenging periods such as the COVID-19 era.

A comparison between our investigation and Li et al.'s global study on diabetes in COVID-19 patients reveals consistent trends. Both studies emphasize the enduring impact of hypertension, cardiovascular disease, and the increased risk of severe outcomes associated with diabetes. Aligning with Li et al.'s findings, our analysis recognizes age shifts during the pandemic, indicating evolving patterns in diabetes prevalence. The studies collectively underscore the critical need for prioritizing diabetes management in the context of COVID-19. Additionally, the dynamic nature of treatment strategies and the importance of detailed glycemic control are mutually acknowledged, providing a cohesive understanding of healthcare adaptations during and after the pandemic. Together, these insights contribute to a comprehensive view of challenges and changes within the diabetic patient population over time.

CONCLUSION

This comprehensive exploration of COVID-19's impact on diabetes, unveils dynamic shifts in patient profiles, treatment strategies, and health outcomes. Age and comorbidity patterns reflect the evolving landscape during and post-COVID, echoing the broader narrative of healthcare adaptation. Notably, hypertension and cardiovascular concerns persist, emphasizing their enduring link with diabetes. Medication trends reveal pandemic-induced challenges, witnessed through prescription variations, while a post-COVID era signals adaptability and diversification in treatment approaches. Our refined glycemic monitoring, encompassing lab values in the post- COVID study, signifies an advanced, holistic assessment. Disparities in creatinine levels expose the pandemic's potential strain on renal health. Comparisons with global studies reinforce the consistent prevalence of key comorbidities, emphasizing the universal need for nuanced diabetes management. This collection of insights underscores the imperative for tailored, adaptive healthcare strategies amid the intricate interplay of infectious and chronic diseases.