Care CEUs

Continuing Education for Nursing Home Administrators

Diabetes Mellitus (DM)

Section 1: Introduction

Diabetes mellitus affects a substantial portion of the American population. In 2021, it was estimated that 11.6% of the American population, or 38.4 million people, had some form of diabetes. Of those, 38.1 million were adults, which accounts for 14.7% of all American adults. 8.7 million people had undiagnosed diabetes, which is 3.4% of the adult population. The incidence of diabetes increases with age, with 29.2% of adults older than 65 having been diagnosed (CDC, 2024b). The global number of individuals with diabetes rose from 108 million in 1980 to 422 million in 2014. The global mortality rate increased by 3% from 2000 to 2019 (WHO, 2023). With the prevalence of diabetes in the United States and worldwide being significant, nurses will encounter patients with diabetes in every career setting. Even when the patient is receiving care that is not directly related to diabetes, their care will be affected by the disease. Therefore, it is pertinent that nurses are aware of the different types of diabetes, risk factors, prevalence, common symptoms, and diagnostic methods. Nurses should understand the lifelong consequences of diabetes and how it affects their patients. Research on this disease, its treatments, and preventative methods is ongoing and robust, so nurses must stay current on new discoveries and interventions.

Section 2: What is Diabetes Mellitus?

Diabetes mellitus is a disease process in which the body cannot manage blood glucose through its usual process of insulin production (Sapra & Bhandari, 2023). This may be due to the pancreas no longer producing enough insulin, or any insulin at all, or the body not responding to the insulin effectively. Typically, when glucose, most often from carbohydrates, is consumed, the body transports the glucose to cells throughout the body to provide energy (Cleveland Clinic, 2023). A

polypeptide hormone, insulin, is required for the glucose to enter those cells. Insulin is produced in the beta cells in the islets of Langerhans in the pancreas. Insulin controls the blood glucose levels in the bloodstream and contributes to glucose storage (Rahman et al., 2021). When insulin is unavailable, or the body is not responding to it, the glucose concentration in the bloodstream increases. When blood glucose is consistently increased, it can have multisystemic effects on the body (Cleveland Clinic, 2023).

Diabetes was first documented by Egyptians around 1500 BC and was noted to be a rare condition where an individual urinated excessively and lost significant amounts of weight. Aretaeus, a Greek physician who lived 80-130 AD, used the term Diabetes mellitus to describe the condition due to the sweet taste of the urine in these individuals. In 1776, Matthew Dobson was able to measure the urine glucose of these patients and found that it was significantly increased from the measurements of those without the condition. In 1812, diabetes was acknowledged by the New England Journal of Medicine as a clinical condition. At the time, no known treatment was available, and the disease was fatal. In 1889, Joseph von Mering and Oskar Minkowski discovered the relationship between the pancreas and diabetes. Then, in 1910, Edward Albert Sharpey-Schafer determined that the cause of diabetes must be due to a lack of a particular chemical produced by the pancreas, which he called insulin. Insulin was not discovered until 1921 when Frederick Banting and Charles Best were able to reverse the effects of diabetes in canine subjects by using an extract of the islet cells from the pancreas of healthy dogs. They then worked with James Collip and John Macleod to develop a purified form of bovine insulin to treat patients with insulin for the first time. The astounding success of this treatment rapidly became very popular and has become a pivotal discovery in healthcare (Polonsky, 2012). While research and innovation in the area of diabetes have made an astounding impact, more

research and treatment development are needed to continue to improve the care patients with diabetes mellitus receive.

Types of Diabetes Mellitus

Diabetes is categorized into types based on the underlying cause of the disease. Most people diagnosed with diabetes have either type 1 or type 2, but there are other, less common causes (Solis-Herrera et al., 2015).

Type 1

This type of diabetes is an autoimmune disorder that causes the immune system to destroy the pancreas's insulin-producing cells, causing them to either not make enough insulin or to stop making it altogether. Type 1 diabetes is typically diagnosed in childhood or adolescence but can begin at any age (Cleveland Clinic, 2023). When the onset is at a younger age, the beta-cells that produce insulin are usually destroyed at a faster rate, resulting in ketoacidosis. The destruction is slower for adults and may not progress to ketoacidosis before diagnosis (Solis-Herrera et al., 2015). Because of the usual onset during childhood and adolescence, type 1 diabetes used to be called juvenile diabetes or insulin-dependent diabetes. The exact underlying cause of type 1 diabetes remains unknown, but genetics are a factor, and some viruses may contribute to the onset of the disease. There is no cure for type 1 diabetes, and treatment focuses on blood glucose management through insulin administration and maintaining a healthy lifestyle (Mayo Clinic, 2024).

Type 2

This is the most common type of diabetes, caused by the pancreas either not producing enough insulin or the body's cells not responding to insulin as they

should. It typically occurs in adults but can also affect children (Cleveland Clinic, 2023).

Gestational

This type of diabetes is specific to pregnant women who have never been diagnosed with diabetes previously. This type of diabetes usually develops around the 24th week of pregnancy, and routine screening typically occurs sometime in the 24-28 week gestational period. Often, this type of diabetes has mild symptoms that could be attributed to pregnancy in general, so routine screening is necessary. Hormonal changes, weight gain, genetic predisposition, previous insulin resistance, and other factors contribute to the onset of gestational diabetes. Approximately 50% of women diagnosed with gestational diabetes will eventually experience type 2 diabetes in their lifetime (CDC, 2024a).

Prediabetes

One in three adults in the United States meets the criteria for diagnosis of prediabetes. Individuals with prediabetes have a fasting blood glucose level between normal and what is considered the threshold for diabetes. Approximately 10% of individuals diagnosed with prediabetes progress to having type 2 diabetes in their lifetime (Echouffo-Tcheugui et al., 2023).

More Rare Forms of Diabetes

Type 3c Diabetes

This type of diabetes occurs when damage to the pancreas is present and is not caused by an autoimmune disorder. Pancreatitis, cancer, cystic fibrosis, trauma, and hemochromatosis can all cause damage to the pancreas, which inhibits its

ability to produce enough insulin to manage the body's blood glucose effectively (Cleveland Clinic, 2023).

Latent Autoimmune Diabetes in Adults (LADA)

LADA, a rare subtype of type 1 diabetes, has a prolonged onset (ElSayed et al., 2023). It is caused by an autoimmune disorder, but individuals are typically not diagnosed until after thirty years of age (Cleveland Clinic, 2023). Due to its slow progression, individuals often do not have to administer insulin at first, as their pancreas continues to produce some insulin. This type of diabetes is often called "Type 1.5" since it occurs in adults long past the usual age for a type 1 diabetes diagnosis and is often mistaken for Type 2 diabetes (Castro, 2023).

Maturity-onset Diabetes of the Young (MODY)

Also known as monogenic diabetes, this type occurs due to a genetic mutation that inhibits insulin production and affects how the body uses insulin. This type of diabetes is inheritable (Cleveland Clinic, 2023). Several genetic variations can cause MODY, and the specific type of mutation determines the treatment. When there is a family history of early-onset diabetes, MODY should be considered as a possibility (Tosur & Philipson, 2022).

Neonatal Diabetes

This is a rare type of monogenic diabetes that occurs in infants within the first six months of life. It can be a permanent condition, called permanent neonatal diabetes mellitus, or resolve within a few months, which is called transient neonatal diabetes mellitus (Cleveland Clinic, 2023). Neonatal diabetes differs from type 1 diabetes because a diagnosis with an autoimmune cause is not likely in the early stage of infancy. Infants with neonatal diabetes are more likely to be born small for gestational age, premature, and feed voraciously but fail to thrive. Severe

dehydration due to diabetes is a significant threat to these infants (Greeley et al., 2021).

Brittle Diabetes

This is a form of diabetes characterized by frequent and severe fluctuations in blood glucose, leading to repeated hospitalizations. Due to the severity of brittle diabetes, a pancreas transplant may be indicated (Cleveland Clinic, 2023). Technically, brittle diabetes is not a particular type of diabetes; instead, it describes a particular individual's condition and can be used to describe someone with type 1 diabetes or severely insulin-deficient type 2 diabetes. The severe fluctuations in blood glucose could be due to psychological factors, a co-existing medical condition, advanced age, or food insecurity. It is essential to address the cause of the instability to stabilize the blood glucose levels (Hirsch & Gaudiani, 2021).

Section 2 Personal Reflection

Why do you think it is necessary to have different classifications of diabetes? How is type 1 diabetes different from type 2? How do they both differ from gestational diabetes?

Section 2 Key Words

Diabetes mellitus - a metabolic disorder characterized by insufficient secretion or utilization of insulin resulting in excess glucose in the circulatory system

Insulin - a protein hormone secreted by the beta cells of the islets of Langerhans in the pancreas that is required for the metabolism of carbohydrates and regulation of glucose levels in the circulatory system

Glucose - a crystalline sugar that occurs in nature and is the form of carbohydrate assimilated by humans

(Merriam-Webster, n.d.)

Section 3: Risk Factors for Diabetes Mellitus

Risk factors for diabetes mellitus often depend on the type of diabetes. Type 1 diabetes is more likely to occur when there has been a family history of the disease since there are some genetic causes. Individuals with two antibody markers for an autoimmune disease that affects the pancreas have a 75% likelihood of developing type 1 diabetes within ten years (Nederstigt et al., 2019). Geography is also a risk factor for type 1 diabetes, as the prevalence of type 2 diabetes increases the further away locations are from the equator. The onset of type 1 diabetes tends to occur during certain ages, between 4 and 7 years, and then again between ages 10 and 14 (Mayo Clinic, 2024). The exact cause of the autoimmune response is unknown, but the environment may be a factor (NIDDKD, 2024a). Infants diagnosed with the rubella virus at birth have a significantly higher risk of developing type 1 diabetes later in life (Korkmaz & Ermiş, 2019).

Type 2 diabetes is more likely to occur when there is a family history, the individual is overweight, older than 35 years, is sedentary, smokes either tobacco or e-cigarettes, has prediabetes, or has a history of gestational diabetes. Type 2 diabetes also occurs more commonly in individuals who are African American, American Indian, Asian American, Hispanic, Latino, or Pacific Islander (NIDDKD, 2024a). Individuals who have increased intra-abdominal fat, as opposed to more body fat being in other areas of the body, are at higher risk of developing type 2 diabetes. There is a genetic factor to the development of type 2 diabetes, but it is not yet well understood. Some medications, like corticosteroids and beta-blockers,

can increase the risk of type 2 diabetes by contributing to insulin resistance (LaPreze & Robinson, 2021).

Risk factors for gestational diabetes include having delivered an infant who weighed over nine pounds at birth, a history of gestational diabetes in a prior pregnancy, being overweight, having a family history of type 2 diabetes, having a history of polycystic ovarian syndrome (PCOS), and some ethnicities (CDC, 2024a).

Section 3 Personal Reflection

What are the common risk factors for type 1 diabetes? What are the risk factors for type 2 diabetes? What risk factors do they share? Why do you think the risk factors for type 2 diabetes and gestational diabetes are similar?

Section 4: Prevalence

The prevalence of diabetes mellitus can be complicated to accurately determine since many cases of diabetes are undiagnosed until symptoms worsen, an acute event occurs, or routine screening is performed during a clinic visit. While there have been many advances in the treatment of diabetes, the prevalence of diabetes has soared worldwide (WHO, 2023). According to the Centers for Disease Control and Prevention, 3.4% of all American adults meet the diagnostic criteria for diabetes but are unaware they have the disease. This number of undiagnosed individuals accounts for almost 23% of all people with diabetes in the United States (CDC, 2024b). Approximately 90-95% of individuals with diabetes mellitus have type 2 diabetes (NIDDKD, 2024a). Only 5.7% of adults with diabetes are diagnosed with type 1 diabetes (CDC, 2024b). Gestational diabetes affects approximately 8-9% of pregnant women, though this number is higher in areas where type 2 diabetes is more prevalent (Eades et al., 2024).

Diabetes is a prevalent disease in the United States, with 11.6% of the total population and 14.7% of all adults having diabetes. Of the adults, 29.2% of all individuals older than 65 have diabetes mellitus. Comparatively, the number of children with diabetes is much lower, with 0.3% of children under the age of 20 having been diagnosed. While children can be diagnosed with type 2 diabetes, type 1 diabetes is more common for this group (CDC, 2024b). Estimates claim that the global rate of diabetes will increase by 61.2% from 2021 to 2025 due to a drastic increase in new cases of type 2 diabetes (Ong et al., 2023).

The prevalence of diabetes mellitus among different racial and ethnic groups varies. In the United States, 13.6% of American Indians and Alaska Native adults had diabetes, followed by 12.1% of non-Hispanic African American adults, 11.7% of Hispanic Americans, 9.1% of non-Hispanic Asian Americans, and 6.9% of Caucasian American adults (CDC, 2024b).

Educational, socioeconomic, and geographical differences were also found among individuals with diabetes. Of people who did not achieve a high school diploma, 13.1% had diabetes, significantly higher than the rate for adults who had a high school diploma or higher level of education, which was 9.1%. Of those with advanced education after high school, only 6.9% had diabetes. Individuals with a household income over $75,000/year were significantly less likely to have diabetes. Individuals living in more rural areas were more likely than those in urban areas to have diabetes (CDC, 2024b).

The prevalence of diabetes is rising at a fast pace in low- and middle-income countries. From 2000-2019, the mortality rate of those with diabetes in lower-middle-income countries increased by 13%, which is much higher than the 3% increase seen in other parts of the world (WHO, 2023). In 2021, the Middle East and North Africa had the highest prevalence of diabetes, at 18.1% of the adult population, followed by North America, the Caribbean, and Southeast Asia.

Europe had the lowest prevalence of diabetes. While Africa had the lowest number of individuals diagnosed with diabetes, it had the most significant percentage estimate of individuals with undiagnosed diabetes (International Diabetes Federation (IDF), 2021).

Section 4 Personal Reflection

What factors may contribute to individuals with diabetes being undiagnosed? Why do you think the prevalence of diabetes has increased? How do geographic location, race, ethnicity, education level, and income impact the prevalence of diabetes? Why do you think the prevalence has increased in developing nations?

Section 5: How is Diabetes Mellitus Diagnosed?

When patients present to the clinic with symptoms consistent with diabetes mellitus, they should be tested for the disease. Common symptoms include increased thirst, increased urinary frequency, continued hunger after eating, blurred vision, poor wound healing, fatigue, and increased incidence of infections. Individuals with type 1 diabetes may also complain of unexplained weight loss. The symptoms of type 1 diabetes typically develop over a few days or weeks, but in adults, it may take longer to become apparent. Symptoms of type 2 diabetes usually progress slowly over several years, and individuals may have very mild symptoms or no symptoms at all. Individuals with risk factors for type 2 diabetes should be tested for the disease. Most patients with gestational diabetes have no symptoms at all and are diagnosed during routine screening during their pregnancy (NIDDKD, 2024a).

Different methods exist for testing for diabetes, depending on the symptoms present and the type of diabetes the provider suspects.

Fasting Plasma Glucose (FPG) Test: This blood glucose measurement is taken after at least eight hours of fasting and is typically done in the morning. Patients can have sips of water during fasting but nothing else to eat or drink for accurate results. This test provides data representing one moment in time, whereas other tests may give more information regarding the overall trend of blood glucose levels. A normal result is a blood glucose level of 99 mg/dL or less. A blood glucose level of 100-125 mg/dL suggests prediabetes and a level of 126 mg/dL or greater indicates the patient may have diabetes mellitus (NIDDKD, 2024a).

A1C test: This test provides a more long-term picture of how the body is able to manage glucose levels. It measures the amount of glucose bound to hemoglobin in the blood cells (Mayo Clinic, 2024). The results, reported in percentages, encompass the past 2-3 months of average glucose management. The patient can eat and drink prior to this blood test. Normal results are below 5.7%; 5.7-6.4% indicates prediabetes and greater than 6.5% suggests the patient has diabetes mellitus (NIDDKD, 2024a). This test is typically repeated if the results are abnormal. Two consecutive results of a hemoglobin A1C greater than 6.5% indicate that the patient has diabetes (Mayo Clinic, 2024). This test may also be known as hemoglobin A1C, HbA1C, glycated hemoglobin, and glycosylated hemoglobin test (NIDDKD, 2024a). In some situations, the A1C test may not be the most accurate option when testing for diabetes. Hemolytic anemia, iron deficiency, hemoglobinopathies, pregnancy, and uremia can all affect the accuracy of the A1C test. Ethnicity can also affect the accuracy of the test, with African Americans being more likely to have a false positive result (Echouffo-Tcheugui et al., 2023).

Random plasma glucose test: This test does not require fasting. When symptoms of diabetes are present, a plasma glucose of greater than 200 mg/dL indicates diabetes (NIDDKD, 2024a).

Glucose challenge test: This test is typically used for gestational diabetes screening in pregnant women. The patient does not need to fast before this test. First, a blood sample is taken, and then the patient consumes a fluid with a high glucose concentration. An hour later, another blood glucose measurement is taken. If the patient's blood glucose exceeds 135 mg/dL, they must complete an oral glucose tolerance test (NIDDKD, 2024a).

Oral glucose tolerance test: This test can diagnose type 1, type 2, or gestational diabetes. The individual must fast for eight hours before the start of this test, though they should have consumed an adequate amount of carbohydrates (at least 150 g/day) for the three days prior to the test (ElSayed et al., 2023). A blood glucose level is checked before the test begins. Then, the patient consumes a high-glucose fluid. After two hours, the blood glucose is rechecked. At this point in the test, a normal result is 139 mg/dL or lower. A level of 140-199 mg/dL indicates prediabetes and 200 mg/dL or greater indicates the patient likely has diabetes mellitus. When this test is conducted to assess for gestational diabetes, the blood glucose levels are usually measured every hour for 2-3 hours after consuming the high glucose fluid. If the blood glucose is high for at least two results, the patient likely has gestational diabetes (NIDDKD, 2024a). This test may also be conducted earlier in a woman's pregnancy if the provider is concerned due to other risk factors (CDC, 2024a).

Typically, more than one test is used to determine if a patient has diabetes mellitus. If one test suggests diabetes and the other does not, the test that suggests diabetes is repeated. The confirmation of another abnormal result indicates that the patient has diabetes. The provider should also consider factors that may have altered the results, such as a patient receiving hemodialysis, which would alter test results. Alternative screening methods are being explored. Since periodontal disease is prevalent in patients with diabetes, research regarding diabetes screening in dental offices is being conducted. Researchers are trying to

determine if this may be an effective way to identify patients with diabetes and refer them to their primary care physician for further testing (ElSayed et al., 2023).

These tests assist in diagnosing diabetes but do not inform the provider which type of diabetes the patient may have. Further testing is necessary to determine the type. Genetic testing may be necessary to determine if the cause of diabetes is monogenic (NIDDKD, 2024a). This is typically done when infants are diagnosed with diabetes and is mandatory when the infant is less than six months of age (ElSayed et al., 2023). A test for autoantibodies to insulin can determine if the cause of diabetes is autoimmune, which would indicate type 1 diabetes. Autoimmune antibodies may also be tested if there is a close genetic relation to someone with type 1 diabetes. This can help determine a patient's risk for developing the disease (NIDDKD, 2024a). The urine is tested for ketones, a byproduct of fat breakdown. The presence of ketones in the urine typically suggests type 1 diabetes (Mayo Clinic, 2024).

Section 5 Key Terms

Screening - a system for examining and determining if a patient is a high or low risk for a condition

Genetic - caused by the DNA of an individual

Auto-immune - caused by autoantibodies that attack the molecules, cells, or organs of the individual that produces them

(Merriam-Webster, n.d.)

Section 5 Personal Reflection

Why do you think the symptoms of type 1 diabetes present over days to weeks while the symptoms of type 2 diabetes may take years to become apparent? What are the advantages and disadvantages of the different blood glucose level testing methods? Why does the cause of diabetes matter?

Section 6: Lifelong Consequences

Chronic hyperglycemia can cause complications with lifelong implications. Microvascular, macrovascular, and neuropathic complications can occur in patients with any type of diabetes (Sapra & Bhandari, 2023). As of 2021, Diabetes mellitus was the eighth leading cause of death in the United States (WHO, 2024), with stroke and heart attack being the cause of death for two-thirds of those with diabetes mellitus (Sapra & Bhandari, 2023). Chronic hyperglycemia damages blood vessels and the nerves that affect the circulatory system. This can lead to coronary artery disease and atherosclerosis. It is incredibly vital that patients with diabetes do not smoke, as this contributes to cardiovascular disease and significantly increases the risk of lung disease, lower limb infections, and amputations (NIDDKD, 2024a).

Neuropathy can affect those with diabetes. This often causes numbness, tingling, and pain in the extremities. Nephropathy may lead to kidney failure, which can result in the patient requiring dialysis or a kidney transplant (Cleveland Clinic, 2023). Diabetes mellitus is the most frequent cause of End Stage Renal Disease (ESRD). Retinopathy can cause blindness and is the most common cause of blindness for patients aged 20-74 years in the United States (Sapra & Bhandari, 2023). Foot-related problems are common in patients with poorly managed diabetes mellitus. This can contribute to wounds, infections, decreased mobility, and possible amputation. Skin infections are common for those with poorly

controlled blood glucose levels. Nerve and blood vessel damage can also cause sexual dysfunction, which may include erectile dysfunction and vaginal dryness. Gastroparesis, hearing loss, and periodontal disease can also occur. Mental health is affected by diabetes mellitus. Individuals with diabetes have a 2-3 times greater risk of being diagnosed with depression than individuals without diabetes (Cleveland Clinic, 2023). Diabetes mellitus is linked to some types of cancer, dementia, and sleep apnea (NIDDKD, 2024a).

A diagnosis of type 1 diabetes means the patient will have to manage their blood glucose levels with insulin for the duration of their lifetime and that they are prone to hypoglycemia. The patient will have to adjust their diet to limit animal products and processed carbohydrates, which can be a drastic change for some. Other changes the patient may experience include being mindful of their physical activity, which is important but may also lower blood glucose levels. When someone with type 1 diabetes becomes involved in a new physical activity, they should monitor their blood glucose more frequently to learn how the activity affects their glucose levels. Individuals with type 1 diabetes also must be mindful of their blood glucose levels when driving and working. They may have to modify their work schedule to ensure they can monitor their blood glucose and eat when necessary. Women with type 1 diabetes will need close monitoring during pregnancy. Individuals may have other conditions that affect their blood glucose levels, like chronic illness, which may also need to be closely monitored (Mayo Clinic, 2024). Diabetic ketoacidosis (DKA) is more likely to affect those with type 1 diabetes. When the body does not have enough glucose for energy, it begins to break down fat. Ketones, a byproduct of this process, can make the blood become acidic, which causes vomiting, dehydration, labored breathing, and loss of consciousness (Cleveland Clinic, 2023). This condition requires immediate medical treatment of rehydration, insulin administration, electrolyte management, and close monitoring (Sapra & Bhandari, 2023).

Individuals with type 2 diabetes should be aware of complications that may affect them. Hyperosmolar hyperglycemic state (HHS) can affect those with a blood glucose level greater than 600 mg/dL for a prolonged period. Dehydration, tachycardia, tachypnea, and confusion can occur, and immediate medical treatment is necessary (Cleveland Clinic, 2023). HHS can present similarly to DKA but without ketones present in the urine. Like DKA, the treatment includes aggressive hydration, electrolyte management, and insulin administration (Sapra & Bhandari, 2023).

Adjusting to a healthier lifestyle may take a lot of work for patients. There will be a lifelong need to consume a healthy diet, continue blood glucose monitoring, possible medication administration, and adhere to a routine follow-up schedule with providers. Consistent blood glucose management can significantly decrease the risk of life-altering complications from diabetes mellitus (Cleveland Clinic, 2023). For newly diagnosed patients, blood glucose management in the first year after diagnosis was an important indicator of the patient's future health. Those with a hemoglobin A1C consistently greater than 6.5% in the first year after diagnosis had worse outcomes (Laiteerapong et al., 2019).

Section 6 Key Terms

Hyperglycemia - excess level of glucose in the blood

Hypoglycemia - insufficient level of glucose in the blood

Neuropathy - dysfunction of one or more nerves due to damage, usually in the peripheral nervous system

Nephropathy - abnormal functioning of the kidney

End Stage Renal Disease - the final stage of kidney failure that is characterized by the complete and irreversible dysfunction of the kidneys

Diabetic Ketoacidosis (DKA) - decreased pH of the blood due to excessive ketones in the bloodstream, which can occur in diabetic patients with poor glycemic control

Hyperosmolar hyperglycemic state (HHS) - A medical state that occurs when the blood glucose level has been greater than 600 mg/dL for an extended period, with similar symptoms to DKA, but without ketones in the circulatory system

(Merriam-Webster, n.d.)

Section 6 Reflection Questions

How can patients with diabetes reduce their risk of complications? Why is it crucial for patients with diabetes not to smoke? What education can you provide to patients who smoke and are prediabetic? What is the difference between DKA and HHS? Why do you think it may be difficult for some patients with diabetes to adjust their lifestyle after diagnosis?

Section 7: Current Treatments and Prevention

The prognosis for patients with diabetes mellitus varies and depends on glucose management. Chronic hyperglycemia contributes to the risk of complications. Diabetes and complications from the disease are a leading cause of death, making glucose management the highest priority for these patients (Sapra & Bhandari, 2023). Blood glucose levels can be monitored in multiple ways. Patients can obtain a capillary blood sample at home through a finger stick and then use a home glucometer to determine their blood glucose level. In the clinic, plasma blood glucose can be measured using a venous blood sample and laboratory equipment (Mathew & Tadi, 2020). Continuous blood glucose monitoring (CGM) is also available to reduce the number of fingerstick checks. A sensor is placed under the

skin and transmits the results in real-time to a mobile device. Many CGM brands are available, and technology is continuously advancing to produce more accurate results and user-friendly methods. Some CGMs can communicate with an automated insulin delivery system to balance blood glucose levels continuously (Cleveland Clinic, 2024).

There are different types of synthetic insulin used for blood glucose management, and they are classified by the rate of onset and duration of action. A rapid-acting insulin is generally administered immediately before consuming food as its onset is within 15 minutes, reaches its peak effect in one hour, and lasts 2-4 hours. There is also an inhaled version of this type of insulin available. Regular or short-acting insulin has an onset of 30 minutes, a peak effect in 2-3 hours, and a duration of 3-6 hours. This type of insulin is usually administered 30-60 minutes before a meal. Intermediate-acting insulin can be used with rapid-acting or regular insulin and may be used to control blood glucose for half the day or overnight. Intermediate-acting insulin has an onset of 2-4 hours, peaks after 4-12 hours, and lasts 12-18 hours. Long-acting insulin is used with shorter-acting insulin to provide a steadier baseline control of blood glucose. The onset of action is after 2 hours and lasts 24 hours. There is no peak effect time for this type of insulin. Ultra-long-acting insulin is also available, similar to Long-acting, but can control blood glucose for 36 hours or longer. Pre-mixed insulin combines long-acting and short-acting insulin so that they can be administered with one injection. It is usually administered 10-30 minutes before a meal, and the duration depends on the ratio of long to short-acting insulin in the mixture (CDC, 2024c). Once dosage needs are established, an insulin pump can minimize the number of injections. Some insulin pumps can also communicate with the glucometer for ease of use for the patient. These management systems require partial manual input from the user, such as grams of carbohydrates consumed, and occasionally, blood glucose level confirmation may be required (Mayo Clinic, 2024).

For individuals with type 2 diabetes or prediabetes, treatment methods include glucose management through oral medications, lifestyle changes, and weight loss. Some patients require insulin injections. Oral diabetes medications, such as Metformin, manage blood glucose levels when the patient's pancreas still produces some insulin. Individuals with gestational diabetes may also use oral medications to help manage blood glucose. Dietary management of the disease focuses on counting carbohydrates consumed and limiting them to a daily amount (Cleveland Clinic, 2023). A healthy diet of fruits, vegetables, whole grains, and limiting animal products and refined sugars is recommended (Mayo Clinic, 2024). Daily physical exercise can reduce the severity of type 2 diabetes or prediabetes (Echouffo-Tcheugui et al., 2023). Physical activity reduces insulin resistance, making it essential for patients (Cleveland Clinic, 2023).

Hypoglycemia is a complication that can occur in individuals with any type of diabetes. Patients and their caregivers should be educated on the symptoms of hypoglycemia, including blurred vision, disorientation, reduced motor coordination, and seizures (Cleveland Clinic, 2023). Some patients may not feel symptoms of hypoglycemia. This is called hypoglycemia unawareness, and it can be particularly dangerous because blood glucose levels can become critically low (Mayo Clinic, 2024). Patients should always have glucagon available for emergency administration in case they experience severe hypoglycemia (Cleveland Clinic, 2023).

Individuals with diabetes may require additional treatments to reduce the risk of complications. They may be prescribed medications to reduce blood pressure or cholesterol. They should also be educated regarding foot care to prevent ulcers. Patients should be screened routinely for kidney disease. Routine eye exams are also essential to monitor for retinopathy, a common complication of diabetes (WHO, 2023). New medications, such as glucagon-like peptide-1 receptor agonists, like semaglutide (Ozempic) and glucose-dependent insulinotropic polypeptide

(GIP) receptor/ glucagon-like peptide-1 (GLP-1) receptor agonists, like tripeptide (Mounjaro), are being used to improve glycemic control and aid in weight loss (NIDDKD, 2024b). Sodium-glucose cotransporter-2 inhibitors can be used for patients with type 2 diabetes to increase the capability of the kidneys to remove glucose from the body and excrete it as urine (Provenzano et al., 2021). In a recent study of semaglutide use in patients with type 2 diabetes and chronic kidney disease, the need for basal insulin was reduced by 20%, showing a significant reduction in insulin resistance (Aviles Bueno et al., 2022).

Another critical aspect of diabetes management is patient and caregiver education. A diagnosis of diabetes requires significant lifestyle changes to increase the chances of favorable outcomes. Any nurse who encounters a patient with diabetes can provide and reinforce education; however, diabetic nurse educators are essential to help monitor competency and compliance. They can identify barriers to education and help develop an education plan best suited for the patient (Awang Ahmad et al., 2020).

Future treatments for diabetes focus on technology for ease of blood glucose management and medications to decrease the severity and risk of type 2 diabetes. Currently, a closed-loop blood glucose monitoring and insulin administration system that does not require any manual input from the user is being studied through clinical trials. Pancreas transplants are used in rare situations but can be done for very severe cases or for patients requiring a kidney transplant. There is also experimentation being done with islet cell transplantation. New techniques are being studied to improve the outcome of these insulin-producing cells transplanted from a donor pancreas (Mayo Clinic, 2024).

Autoimmune and genetic forms of diabetes mellitus cannot be prevented; however, some interventions can reduce the risk for prediabetes, type 2 diabetes,

and gestational diabetes. Eating a healthy diet, 30 minutes of physical activity at least five days per week, weight management, stress-relieving techniques, limiting alcohol consumption, getting adequate sleep, quitting smoking, and compliance with current medications can all be tools to prevent diabetes. The treatment of prediabetes focuses on improving health to halt the progression of the condition and decrease the likelihood of type 2 diabetes (Cleveland Clinic, 2023).

Section 7 Reflection Questions

How do the different types of insulin affect the blood glucose levels? Why do you think it is necessary to have different types of insulin? How do you think newer technology contributes to positive outcomes? How could new medications change the prevalence of diabetes?

Section 8: Conclusion

Diabetes mellitus is a complex disease with multifaceted potential causes and can impact major organ systems. Nurses in every setting will encounter patients with diabetes and can be prepared to care for them. Certain demographics of people are at an increased risk for diabetes, though type 2 diabetes and prediabetes are most prevalent in individuals who are overweight and sedentary. The prevalence of diabetes is increasing, meaning nurses will continue to care for more and more patients who are diagnosed with the disease and those who are not yet diagnosed but show symptoms of diabetes, like increased thirst, vision changes, and increased urination. Diabetes mellitus continues to be diagnosed through blood testing, and a new diagnosis can significantly impact a patient's life. Complications are common, and lifestyle changes are necessary to manage the disease. Treatment always includes blood glucose management, but other treatment options may help depending on the type of diabetes diagnosed. New medications,

like semaglutide and tirzepatide, are providing a powerful strategy, along with healthy eating and physical activity, to prevent and reverse the effects of some types of diabetes. Through competent care and patient education, nurses can contribute to positive outcomes for patients with diabetes mellitus.

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