



# DIABETES TREATMENT AND MOTIVATIONAL INTERVIEWING

*DIABETES SERIES: PART III*

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## **ABSTRACT**

Current research has improved the medical knowledge and management of diabetes. Knowledge of the main and less common forms of diabetes mellitus, including associated risk factors, laboratory testing and screening, and diabetic treatment are necessary for clinicians to develop a comprehensive and thoughtful plan of patient care. The basics of insulin secretion and metabolism, medical management of insufficient insulin as well as lifestyle and prevention of diabetes are discussed.

## **Policy Statement**

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## **Continuing Education Credit Designation**

This educational activity is credited for 3 hours. Nurses may only claim credit commensurate with the credit awarded for completion of this course activity.

## **Statement of Learning Need**

Health clinicians support patients that have diabetes to understand the nature and treatment of their disease. Knowledge of the current trends in diabetes research and medical management is important for clinicians to provide safe and appropriate communication, interventions and advocacy for the diabetic patient and their family. Educating diabetic individuals about the type of diet they should maintain as well as other lifestyle choices is integral to diabetic health and wellness.

## **Course Purpose**

To provide health clinicians with knowledge of the main types of diabetes mellitus as well as the less common types in order to educate patients, families and peers about the right diabetic treatment and health choices.

## Target Audience

Advanced Practice Registered Nurses and Registered Nurses

(Interdisciplinary Health Team Members, including Vocational Nurses and Medical Assistants may obtain a *Certificate of Completion*)

## Course Author & Planning Team Conflict of Interest Disclosures

Jassin M. Jouria, MD, William S. Cook, PhD, Douglas Lawrence, MA,  
Susan DePasquale, MSN, FPMHNP-BC - all have no disclosures

## Acknowledgement of Commercial Support

There is no commercial support for this course.

**Please take time to complete a self-assessment of knowledge, on page 4, sample questions *before* reading the article.**

**Opportunity to complete a self-assessment of knowledge learned will be provided at the end of the course.**

**1. What reading is indicative of diabetes mellitus in a casual plasma glucose test?**

- a. 200 m/dl
- b. 100 mg/dl
- c. 300 mg/dl
- d. 0 mg/dl

**2. The use of self-management is most suitable for patients with \_\_\_\_\_ who use insulin therapy and regulate their dosage as a result of blood glucose testing.**

- a. diabetes mellitus type I or type II
- b. diabetes mellitus type I only
- c. gestational diabetes
- d. pre-diabetes

**3. In rare cases, Metformin may cause a condition known as**

- a. Kussmaul breathing.
- b. hypoglycemia.
- c. lactic acidosis.
- d. hyperglycemia.

**4. Thiazolidinediones are used to enhance the action of insulin in the body in the**

- a. pancreas and beta cells.
- b. fat and muscles.
- c. pancreas and liver.
- d. liver and kidney.

**5. In the year \_\_\_\_\_, a paper entitled *Motivational Interviewing* written by William R. Miller was published.**

- a. 1980
- b. 1992
- c. 1893
- d. 1983

## **Introduction**

The primary target goals and treatment for diabetic patients to help them achieve blood glucose levels close to normal as possible to prevent complications of diabetes is a high priority for diabetic treatment plan. Laboratory trends of serum blood glucose values have proved insufficient as a sole method to monitor diet, exercise and medication management to maintain normal blood sugar levels at any given time. The HbA1c is a more reliable measure of a diabetic patient's effort to control target blood sugar through improved lifestyle and medical treatment and to avoid long-term complications. Lifestyle and medication management (should it be required) is the mainstay of treatment strategies for the diabetic patient. This study begins with a brief review of diabetes and required testing or monitoring of the blood sugar and HbA1c, and then elaborates on the medical management that includes insulin and various oral drug agents. Importantly, developing a partnership with diabetic patients is a necessary part of a successful treatment plan. Research has shown that motivational interviewing techniques in the primary care setting improve patient compliance with therapy and disease outcomes. Motivational interviewing is a way for health team members to take the patient's perspective into account and encourage dialogue, collaboration and partnership to support health outcomes.

### **Laboratory Testing And Diagnosis Of Diabetes Mellitus**

In pre-diabetic states and diabetes mellitus diagnosis is done through blood testing.<sup>1</sup> This method is used due to the fact that there are little or no symptoms associated with type II diabetes in the initial onset of the disease. All laboratory testing done for diabetes mellitus will involve the drawing of blood from the patient. Blood draw procedures must be carried out in a sanitized and secure environment. When the blood is drawn, it is then

forwarded to a laboratory for the blood analysis to be done, ensuring accuracy of the test results.

The instruments used in the measuring of glucose in usual health facilities may not assure the level of accuracy needed but will allow for efficacy in indicating high blood glucose levels. When laboratory testing is done, it allows for action to be taken at the early stages of diabetes in order to avoid complications. The treatment of pre-diabetes may stop or delay the development of diabetes mellitus type II.<sup>2</sup> The following tests may be used in the diagnosis of diabetes mellitus:

- Fasting Plasma Glucose
- Casual Plasma Glucose
- Glycated Hemoglobin (HbA1c)

All tests carried out in the diagnosis of diabetes mellitus are not suitable for all types of the disease. There are individual test descriptions, which indicate the instructional details for each. The *casual plasma glucose* test is occasionally utilized in diagnosing diabetes when carrying out a regular health checkup. If this test produces a result of 200 mg/dl or higher, along with the usual symptoms which are associated with diabetes, then a diagnosis may be given of diabetes mellitus.<sup>1,2</sup>

A few of the most common symptoms that are associated with patients with the disease are polyuria, weight loss, polyphagia, and polydipsia. A few other symptoms, which may also be observed, are blurred vision, fatigue, and sores. Without the existence or presence of the symptoms of diabetes mellitus, a follow-up test has to be carried out for another measurement. This is to guarantee that the result obtained in the first test is correct. Recommended testing for diabetes are covered here.<sup>1,2,8,9,13</sup>

## **Fasting Plasma Glucose**

The fasting plasma glucose test, also referred to as the FPG test, is used to measure the blood glucose level and in the diagnosis of diabetes mellitus. This is very simple and is also considered to be an inexpensive test used to diagnose the disease. What this test will primarily do is expose any issues and problems that may be present with insulin functions. After a period of prolonged fasting, there will be a triggering of the hormone glucagon; this is the hormone that is produced by the pancreas. This will initiate the release of glucose into the bloodstream from the liver. The expected reaction from the body is to produce insulin, which will prevent the onset of high blood sugar or hyperglycemia. This is however in a patient that does not have diabetes. In a patient with the disease, there will be no production of insulin or an inappropriate reaction of insulin to counteract the release of glucose so the fasting blood sugar will remain at a very high level.

The fasting plasma glucose, as mentioned, is a very simple and noninvasive blood test. Before being tested, a patient is required to refrain from eating for a period of twelve to fourteen hours. This test is usually done in the morning because of the fast required prior to being carried out. The tests are analyzed and interpreted by scrutinizing the glucose levels observed in the blood. The categories of diagnosis include the following and are expressed in milligrams per deciliter (mg/dl):

- The normal range for a fasting plasma glucose test result fall under a range of 70 mg/dl to 99 mg/dl.
- A result that gives a reading of 100 mg/dl to 125 mg/dl is usually diagnosed as pre-diabetes; and, this will give an indication of an increased risk of developing full-blown diabetes mellitus.

- If the reading obtained displays fasting plasma glucose of higher than 126 mg/dl, this is the range at which diabetes mellitus may be diagnosed.
- In the event that the results show blood glucose level that falls below the normal lower boundary of 70 mg/dl, hypoglycemia may be diagnosed, as this is a dangerously low blood sugar level.

If the results obtained are unclear, meaning they are at a reading considered as borderline, then other tests may be done. The alternative test done may be the *oral tolerance test* or the postprandial plasma glucose test. If the result of the fasting plasma glucose test falls within the normal range, there may be another test ordered in order to be able to eliminate the possibility of the development of diabetes mellitus. This is most commonly done for those patients with a normal range result but that still display risks of the disease. This may involve other symptoms of diabetes or a high body mass index.

The results of testing may vary between laboratory sites or even in the same laboratory in the same day. For this reason, additional testing is required. If there are two abnormal results obtained on two different days, then a diagnosis may be confirmed. If the test is carried out and blood is drawn in the afternoon as opposed to the morning, the results that were acquired from testing may be lower. There may also be a false reading of low blood sugar if a long time is allowed to elapse between when the blood is drawn and when the laboratory staff processes the blood. Additionally, the result may be affected if the patient has other medical conditions whether past or present or have habits such as exercise or smoking. The full medical history of the patient must be taken into account when the tests are being conducted as well as when they are being analyzed.



The patient should be encouraged to consult with their health clinician regardless of the results of the test. Not only is this test used for the diagnosis of the disease but it may also be utilized in the prevention of the disease as well. The results that fall in the higher ranges may be due to diet and lifestyle as well as the insulin function. A healthy diet is important whether a person has pre-diabetes, gestational diabetes, or type I or type II diabetes. A healthy diet and lifestyle will aid in the improvement of the insulin functions. The fasting glucose test may signal that preventative action needs to be taken.

### **Casual or Random Plasma Glucose**

The casual plasma glucose test, like all plasma glucose testing, is carried out in order to measure the level of glucose that is being circulated in the blood. This is also referred to as the random plasma glucose and the *casual or random* means that the blood drawn is done at a laboratory at any time. The test will not be affected by having fasted or eaten before the test was carried out. If the results obtained from this test gives a result of 200 mg/dl or higher, this is indicative of a likely diagnosis of diabetes mellitus. In order to be completely accurate with the diagnosis, a follow up test must be done on another day using the same kind of test. In addition to this test, a fasting plasma glucose test may also be carried out subsequently.

### **Glycated Hemoglobin (HbA1c)**

The red blood cells are constituted of a molecule known as hemoglobin. With glycated hemoglobin, the glucose will be attracted and attach to the hemoglobin that results in another molecule, which is referred to as the hemoglobin A1c or HbA1c. The more glucose found in the blood the more HbA1c that will be present in the blood as well. Before being replaced, the red blood cells will remain alive for a period of 8-12 weeks. When the HbA1c

is measured, it will indicate the level of the blood glucose over the course of 8-12 week duration. The normal non-diabetic range for the HbA1c result is generally 3.5 to 5.5%. A generally acceptable range for a patient who has diabetes mellitus is 6.5%. This test is considered to be one of the best methods of finding out if diabetes is under control. After being carried out, this test is then sent to the laboratory and is done at the same time at some medical facilities. It should be noted that the HbA1c is not the same thing as the glucose level.

The HbA1c should be measured at three-month intervals to ensure target levels are reached and blood sugar levels are controlled. The target control is aimed at reducing the HbA1c to under 7%; this means that the patient, if in reasonable health, should attempt to lower their HbA1c result over the short period between the tests. A valiant attempt on the patient's part should be carried out, as results higher than 7% are often indicative of complications of the disease further on. The HbA1c can be measured at six month intervals if there is constant stability of the HbA1c being lower than 7%. The levels of glucose in the blood tend to fluctuate rapidly, from minute to minute, hour to hour and day to day. For that reason, the day-to-day or hour-to-hour control of the blood glucose in diabetic patients is best guided by the results of the glucose test. The HbA1c level will change at a much slower rate over a period of ten weeks. This is why it is mostly used as a *quality control* test.

In a patient that has diabetes mellitus, the level of glucose will generally rise more than normal. It will drop with exercise, rise after a meal is consumed and increase even more when sweet food is consumed. This will make it much harder to control. Coincidentally, the HbA1c levels are almost equal to the level of glucose. For example, if the HbA1c level over the course of ten

weeks was found to be 10%, the average glucose level for those ten weeks would have been 235 mg/dl. As the levels become even lower, the difference between the two will also experience a decrease. If the HbA1c were at 7%, the average level of glucose would be 145 mg/dl.

The results obtained from the laboratory may vary according to the analytical techniques used; as well as, the biological variation that is found among individuals and the age of the subject. Two patients that have the same average blood sugar may have HbA1c values differing by an amount of up to three percentage points. In various circumstances, blood sugar results may prove very unreliable; such as situations that result in a loss of blood, for example, after surgery, after a blood transfusion or in the presence of anemia.

### **Repeat Laboratory Testing**

In order to make an accurate diagnosis of diabetes mellitus, there must be a repeat of the test that is being used in the diagnosis. This repeat test must be done on a separate day to allow for complete accuracy and efficacy. However, for a diagnosis of pre-diabetes, a second test does not have to be carried out. The exception to this is in the event that treatment with medication is being considered for the patient. Unless there is a confirmed diagnosis of impaired glucose tolerance as well as impaired fasting glucose, it is not advised that a patient with pre-diabetes be put on medication.

### **Self-Monitoring of Blood Glucose**

The recommendation of *self-monitoring* is a method that may be used by patients with diabetes mellitus to measure their blood glucose concentrations. This method is an accurate one and will be helpful in detecting both hyperglycemia and hypoglycemia. It has been a highly

debated topic as to whether or not it is a necessity to frequently monitor blood glucose levels in patients with diabetes. The main focus of this debate is the balance between the increasing National Health Service (NHS) expenditure for the monitoring of blood glucose and the benefit to the patient.

Self-monitoring addresses the importance of the participation and empowerment of patients with diabetes in their own management and monitoring. When blood glucose levels are strictly monitored, it will assist in improving the outcomes of those patients that suffer from diabetes mellitus type I and type II. It is still undetermined, however, whether or not self-monitoring really contributes to this improvement. In order for self-monitoring of blood glucose to be useful, it must be a component of a bigger diabetes management plan.

The use of self-management is most suitable for patients with diabetes mellitus type I or type II who use insulin therapy and regulate their dosage as a result of blood glucose testing. It may be also used for all diabetic patients that have another illness along with diabetes. Health professionals in the field of diabetes management need to educate patients on the requirement for self-testing of glucose based on the treatment recommended for diabetes as well as the level of glycemic control that is necessary for the needs of the patient. Adequate training must be provided for patients in the techniques that are used for self-monitoring. This training must be inclusive of how results must be interpreted when obtained and the actions that must be taken based on these results.

There are many patients with diabetes mellitus who practice self-management by relying on many books or manuals that explain monitoring

techniques and result interpretation; however, often patients still do not fully comprehend these results. There should be a complete understanding by patients of the implications of the results as well as a full understanding of diabetes disease management. Patients should be checked at regular intervals by their health clinicians in order to ensure that self-monitoring results obtained are accurate.

### **Urine Glucose Monitoring**

One method of monitoring glucose is through a urinalysis. When compared to blood glucose monitoring, this method is regarded as being highly inexact for the monitoring of glucose levels in patients with diabetes mellitus. While there is evidence to support that self-monitoring is effective for medical management in patients with diabetes there is no supporting evidence that urine glucose testing is any less effective than blood glucose monitoring.

The monitoring of blood glucose control through urine monitoring may be used as an alternative method to blood glucose monitoring for those patients suffering from type II diabetes and being managed by diet and/or oral medication. It may be used in addition to frequent HbA1c blood tests. It must not, however, be used in place of blood glucose monitoring in patients with diabetes mellitus type I. The advantages and disadvantages of urine testing for diabetes mellitus are listed below:

#### *Advantages*

- This is a very simple test to carry out and it does not require the use of a meter which may have maintenance and battery needs.
- Urine testing is a very cost effective method for patients with diabetes.
- There are no safety or disposal issues related to lancets, as none are required.

### *Disadvantages*

- When a negative test result is obtained, there is no method of distinguishing between hypoglycemia and normoglycemia.
- The renal threshold of glucose will vary slightly across the board but the threshold is observed to be lower in pregnant women and children so there are more instances of false positive results with these patients; the threshold is higher in the elderly and there will therefore be a greater risk for false negative results.
- The intake of fluid may have an effect on glycosuria.

The level of glycosuria represents the average of the blood glucose levels since the last excretion of urine by the patient. By collecting a sample soon after the bladder is emptied, the problem will therefore be reduced.

## **Medical Management Of Diabetes Mellitus**

The main focal point of diabetes mellitus management is usually the consistent control of the blood sugar level. This is due to the fact that keeping a patient within the target range will lead to a longer and healthier life. It should be taken into account the reasons that are behind the rise and fall of individual patients' blood sugar levels. Across the types of diabetes mellitus, all patients must observe particular lifestyle changes and a diabetes management plan, highlighted in this section.<sup>8,9,13,15,59,63</sup>

### **Diet and Prevention**

A good diet is one of the most important factors in any diabetes health prevention plan. However, what is consumed is not always the main focus. Time of consumption and how much is consumed is also very important to monitor. The main ways of controlling the diet for a patient with diabetes

includes meal scheduling, the types and portioning of meals, as well as meal planning and coordination when diabetic medication is being taken.

### *Meal Schedule*

A patient's blood sugar level will usually increase within an hour or two after a meal, after which it will begin to decrease. This pattern may be used as an advantage by decreasing fluctuations in the blood sugar levels by eating at the same times each day. The patient may also eat several small meals during the course of a day or eat healthy snacks at regulated times in between meals.

### *Meal Types*

A well-balanced diet is essential for any diet, especially that of a patient with diabetes mellitus. Every meal should consist of the right balance of fruits, vegetables, fats, starches and proteins. It is also very important that the same amount of carbohydrates be consumed at each meal, as these will have a great impact on the blood sugar levels. Consultation must be done to assist the patient in making a proper diet that will be suited to individual needs and demands.

### *Meal Portions*

By making note of the correct measurements for each type of food, the patient will be able to manage dieting a lot easier. A scale or a measuring cup may be utilized in order to ensure that the correct portions are being consumed.

### *Meals and Medication Coordination*

If the ratio of food to medication is too low, this may result in the patient experiencing hypoglycemia. This is particularly so in a patient that is treated by insulin. On the other hand, if a patient consumes too much, it may lead to hyperglycemia. A schedule and ratio guide should be set for each patient individually.

### **Exercise**

Engaging in physical activity is also an important factor in the medical management of any diabetic patient. When a patient exercises, the muscles will utilize the sugar as energy. The response of the body to insulin is also improved with the increased level of physical activity. These aspects will all work to lower the blood sugar level. The harder and more demanding the exercise workout, the longer the effects of it will last.

There are some lifestyle management plan guidelines that a diabetes patient may follow, including maintaining an exercise plan and blood sugar checks.

### *Exercise Plan*

Not all exercises are appropriate for every patient. A patient must receive a checkup and a go ahead from a health clinician before engaging in any form of exercise. The condition of a patient's heart and feet are usually checked before they are given advise on exercising.

### *Blood Sugar Level Check*

A patient should be careful in checking the level of blood sugar before, during and after they have engaged in exercise. This is particularly so for patients who take insulin or other medications that will lower the blood



sugar. The clinician should recall the warning signs associated with low blood sugar, which are a feeling of confusion, weakness, shakiness, irritation, hunger, fatigue and anxiety.

## **Medication Management**

In the management of diabetes, medication such as insulin is utilized to lower the blood sugar level when diet and exercise are not sufficient. However, the effect that these medications will have depends upon the time that is taken as well as the dosage. Medications taken for other medical conditions may also have a glucose altering effect as well. Guidelines for insulin management are also necessary to observe, such as proper insulin storage and reporting problems with medication management. If insulin is not stored properly or has passed its projected expiration date, it may no longer be effective. If a patient is experiencing any form of difficulty with their blood sugar level and they are on medication to control it, they should be advised to consult with their health clinician. There may be need for an adjustment of medication dosage.

## **Insulin**

The treatment of diabetes mellitus through the therapy of insulin is recommended for patients that have diabetes mellitus type II or HbA1c level that is greater than 9%. Insulin may also be prescribed if the disease is uncontrolled even after oral glycemic therapy.

The initiation of insulin therapy may be as augmentation and will start at 0.3 unit per kg; additionally, insulin may be administered as replacement and start at 0.6 to 1.0 unit per kg. If the therapy is for replacement, then 50% of the total daily insulin dose is administered as basal (amount of constant insulin required to maintain stable blood glucose levels in between meals

and overnight), while the other 50% is given as a bolus amount that is divided up among the three meals of the day. Augmentation therapy may either be bolus or basal insulin.

Insulin is continuously secreted by the beta cells in a manner that is glucose dependent throughout the course of the day. There is also a secretion of insulin as a response to the oral carbohydrate loads. This includes a *first phase* insulin release, which will suppress the hepatic glucose production. After this a slower *second phase* release of insulin will occur and will cover the carbohydrates that have been ingested. Diabetes mellitus type II is commonly associated with an insulin resistance and a gradual failure of the beta cells. When the disease is diagnosed in patients with type II, a good percentage of the beta cells have already been depleted and are not functioning the way that they should. The rate of the beta cell depletion will continue at a rate of 4% per year. These patients will therefore benefit greatly from insulin therapy as the disease progresses after diagnosis.

### *Injecting Insulin*

Insulin will only prove to be effective in a patient when it is correctly administered. The best points for administering the insulin are in the outer thigh, the abdomen, the buttocks or the back of the arm. When the insulin is being injected, the needle must be held at a 90-degree angle to the skin. After being injected with the insulin, the needle has to be held in place for ten seconds in order to prevent the insulin from leaking out. In order to prevent the occurrence of lipohypertrophy, which is the scarring of tissue from repeated injection at the same place, the injecting point must be rotated. If lipohypertrophy occurs, this will lead to poor absorption of insulin as well as depot formation, which may lead to the random release of insulin.

Random release of insulin may eventually cause delayed hypoglycemia and early postprandial hyperglycemia. Insulin may be obtained in pens or in vials. The advantage of using an insulin pen is that it is easily stored at room temperature for a period of twenty-eight days after it has been opened. It is also very easy to use if the patient is visually impaired or has problems with dexterity. For those patients who suffer from no or poor vision, the pen's clicks will give an account of the number of units. The insulin pen should be primed before each use. This priming will involve the drawing of 2 units and injecting them into the air to ensure that the insulin is filling the needle.

### *Problems with Insulin Therapy*

Insulin therapy may bring along with it weight gain, hypoglycemia and pain. The pain will most commonly be associated with the injections therapy and the glucose monitoring. There have been thinner and shorter needles provided in recent years that help to decrease the associated pain. Due to the anabolic effects of the insulin, a patient may also experience some level of weight gain. The insulin may increase the appetite and cause *defensive eating* to fight against the effects of the hypoglycemia.

The hypoglycemia that may come with insulin therapy may be due to a disproportionate intake of insulin with carbohydrate consumption and exercise. Hypoglycemia has been linked to cardiac arrhythmia as well as an increased risk of dementia. All patients with diabetes mellitus must be instructed on the symptoms and the treatment of hypoglycemia. The American Diabetes Association (ADA) has recommended that once hypoglycemia is suspected, that there be a blood glucose check done. If it is hypoglycemia, it must be treated with a fast-acting carbohydrate, which may be in the form of a glucose tablet or a juice.

### *Combination Insulin and Oral Medication*

Almost all forms of oral medication are safe to be taken along with insulin therapy and prove to be very effective just the same. In order to minimize undesirable effects while at the same time increasing the benefit of the medication, it is important to coach the patient to keep in mind the method of action for the different therapies. Insulin sensitizers have also been shown to be safe to use while undergoing insulin therapy. If metformin was already a part of the medication line up for the patient, it is normally continued indefinitely after insulin treatment is started. This is especially the case in overweight diabetes mellitus type II patients.

The continuation of metformin treatment will minimize the risk of cardiovascular complications. The combination of metformin and insulin therapy has also been associated with a lower insulin dosage, a decrease in weight gain, as well as less hypoglycemia when compared with insulin alone. Thiazolidinediones has been observed to increase the sensitivity to insulin but has the negative side effects of increased weight gain, a risk of congestive heart failure, and fluid retention when it is combined with insulin. This medication has not been proven to reduce the risk of macrovascular complications. Alpha-glucosidase inhibitors are safe and effective when they are combined with insulin. These medications will delay the absorption of carbohydrates into the gastrointestinal tract, which will cause a decrease in postprandial hyperglycemia.

### **Metformin**

Metformin is generally the first choice of medical practitioners for the oral therapy of diabetes mellitus type II. This is prescribed when the patient is showing no response to lifestyle changes that were previously instructed. In the event that the metformin monotherapy fails in the control of

hyperglycemia, a second medication may be prescribed. A current total of 12 classes of drugs have been approved for the treatment of hyperglycemia in patients with diabetes mellitus type II. It is generally observed that most patients will require more than one of these medications.

There is no official data that dictates when the best time is to begin oral therapy for a diabetes patient; however, there are particular factors that may be taken into account instead to determine the best time for each individual patient. This may be based on life expectancy, risks of undesirable effects due to glucose control, macrovascular and microvascular complications as well as patient preference.

Only when insulin is present will metformin prove to be effective. The most important effect of this medication is to decrease the hepatic glucose output. Metformin will also increase the insulin mediated glucose utilization in peripheral tissues such as liver and muscle as well. This increase will occur generally after the patient has consumed a meal. In addition to these effects, metformin also has an antilipolytic effect that will lower the serum free fatty acid concentrations. This will cause a reduction in the substrate, which is available for gluconeogenesis. The improvement in the glycemic control will cause a slight decline in the serum insulin concentrations.

### *Negative Effects of Metformin*

In rare cases, metformin will cause a very serious and sometimes fatal condition known as *lactic acidosis*. A patient should be advised to stop taking the medication and seek medical attention immediately if any of the symptoms listed below occur while taking metformin:

- Dizziness
- Chills

- Severe drowsiness
- Unusual tiredness
- Difficulty with breathing
- Cold or blue skin
- Stomach pain with associated nausea
- Diarrhea
- Vomiting
- Slow or irregular heartbeat

The occurrence of lactic acidosis is most commonly seen in those patients that have serious medical conditions, which may include:

- Recent surgery
- Liver disease
- Kidney disease
- Heavy alcohol use
- A condition such as stroke, congestive heart failure or recent heart attack which may cause low oxygen level in the blood as well as poor circulation.
- Serious infection
- An x-ray or scan, which may have required the use of an injectable iodinated contrast drug
- Dehydration

The elderly are at a higher risk of lactic acidosis, increasingly so when the patient is older than 80 years and has never done a kidney test.

### **Other Oral Medications**

In addition to the insulin therapy, many patients will need another medication to aid in the management of their diabetes. The options that are

available are listed and described below, which include oral and injectable medications.

### *Alpha-glucosidase Inhibitors*

The option to include alpha-glucosidase inhibitors helps to slow down the breakdown of starch in the intestine. This will dull the excessive increase of blood glucose, which will occur after a meal. This medication must be taken at the start of a meal. There are possible side effects of digestive problems, which include diarrhea and gas.

### *Bromocriptine*

Bromocriptine is a medication that will lower blood glucose. This is taken in the morning with a meal and will only be taken once during the course of the day. The treatment is initiated with a single tablet and will increase by one tablet a day until a maximum tolerated dose of 2-6 tablets are taken once daily. This medication is unlikely to cause weight gain or hypoglycemia. There is no adjustment of Bromocriptine that is needed for those patients that have renal impairment, and it is proven to be safe for the heart. The possible side effects that are associated with Bromocriptine are fatigue, nausea, dizziness, vomiting and headaches.

### *Exenatide*

To stimulate the production of insulin, exenatide may be given. When being used as a treatment, exenatide is injected twice a day, before the meal in the morning and in the evening. The possible side effects include weight loss, acute pancreatitis, weight loss, serious inflammation of the pancreas, nausea.

Nausea associated with this medication will subside on its own. There has not been a definite establishment of the cause and effect relationship between the drug and pancreatitis.

### *Linagliptin*

Linagliptin is a medication that is used to lower the blood glucose. It will do so by assisting the body to increase the level of insulin present after meals. It is taken orally, every day as directed by a medical clinician. It may be taken with or without a meal. This drug is not excreted through the kidney; therefore, no dose adjustment will be required for patients who suffer from kidney disease. Patients taking this medication may experience side effects such as stuffy or runny nose with associated sore throat and low blood glucose most commonly when taken with other diabetic medication.

### *Liraglutide*

In order to stimulate the production of insulin liraglutide may be given. It is administered through an injection, which is given once daily. The possible associated side effects of this medication include weight loss, nausea (which may go away on its own), a severe inflammation of the pancreas as well as acute pancreatitis. There has been no definite established relationship between liraglutide and pancreatitis.

### *Meglitinides*

Meglitinides is ordered for a diabetic patient in order to stimulate the production of insulin. This will be taken before the consumption of all three meals. The side effect that has been associated with the intake of this drug has been hypoglycemia; however, it has been observed that hypoglycemia is a lower risk with meglitinides than occurs with sulfonylureas.



### *Pramlintide acetate*

Pramalintide acetate is administered through injection and is used to reduce the amount of insulin required by the patient. This is similar to insulin that is produced in laboratories, as it is an analogue of a hormone that occurs naturally and is released by the beta cells in the pancreas and assists in the control of blood glucose. This medication may also be used for patients that have diabetes mellitus type I. The side effect that has been observed when using pramlintide acetate is nausea. Nausea may however subside over time.

### *Saxagliptin*

Saxagliptin is taken in order to lower blood glucose by assisting in increasing the level of insulin after meals. It is taken orally once daily and may be taken with or without the consumption of a meal. It is not likely to be the cause of hypoglycemia occurrences. The possible side effects that may be associated with this drug are upper respiratory tract infection, headache and urinary tract infection. If saxagliptin is taken along with thiazolidinedianes, patients may also experience fluid retention and swelling.

### *Sitagliptin*

Sitagliptin is used to stimulate the production of insulin by the pancreas. It is taken once per day and may be taken with or without the consumption of a meal. This medication is not likely to cause hypoglycemia. Side effects associated with this medication include allergic reactions and, in rare cases, skin rashes.

### *Sulfonylureas*

The stimulation of insulin production by the pancreas is aided through the use of sulfonylureas. This medication is normally taken once or twice per day before the consumption of a meal. The associated side effects of sulfonylureas include hypoglycemia. The consumption of alcohol when taken along with sulfonylureas may cause a reaction, such as flushing, a warm sensation, dizziness, nausea and tachycardia.

### *Thiazolidinediones*

Thiazolidinediones often referred to as TZDs is used to enhance the action of the insulin in the body in fat and muscle. It is also used to reduce the production of glucose by the liver. TZDs may be taken with or without the consumption of a meal. Associated side effects include, weight gain, rare cases of bone fractures, water retention and congestive heart failure. Particular types of this medication may result in an increased risk of heart attack.

In the treatment of diabetes mellitus type II medications may be taken together as well as individually. Combining medications may prove convenient but may also be disadvantageous as it may be difficult to definitely determine which medication is the cause of negative side effects that may occur.

## **Motivational Interviewing**

The practice of motivational interviewing came about as a result of clinical practice. This practice dates back to the year 1980 when a psychologist, William R. Miller, from Albuquerque, New Mexico visited Bergen, Norway on a vacation. While in Norway, Miller conducted a series of seminars along with

a group of Norwegian psychologists. It was in the interaction with these colleagues that Miller was questioned on the reason he was using particular practices with his patients that struggled with alcohol use. Miller's response to these questions came in the result of a paper, which was titled *Motivational Interviewing* and was submitted to Dr. Ray Hodgson, the editor of the journal *Behavioral Psychotherapy* and was published in 1983. The development and principles of motivational interviewing are briefly discussed here, and learners are referred to the rapidly growing research and publications on the value of motivational interviewing and approaches to improve patient care outcomes.<sup>66-68</sup>

When Miller returned to the United States, he embarked on a mission to merge clinical practice with research. A range of studies was conducted along with his contemporaries in the Department of Psychology at the University of New Mexico. These studies focused on the response of patients to an empathic approach when discussing changes in lifestyle. It was in the year 1989 that Miller met Stephen Rollnick who had been practicing motivational interviewing in the United Kingdom. They got together in Sydney, Australia and from there they wrote the first edition of the standard text, *Motivational interviewing*. In the initial stages of this practice, it was primarily focused on the field of addiction.

In research carried out into the health related changes in behavior, the importance of *motivation, resistance and ambivalence* have been highlighted. Motivational interviewing describes the counseling method that is utilized to increase a patient's motivation for change through four basic principles: 1) Establishing partnership, 2) Listening to the patient, 3) Identifying and resolving ambivalence, and 4) Emphasizing autonomy.

There have been recent meta-analyses that have shown that motivational interviewing has proven effective in the decrease of the use of alcohol and drugs in both adults and adolescents. There has also been evidence to indicate that motivational interviewing is beneficial in stopping smoking, reducing resistance to treatment and medication, reducing risky sexual behaviors and in the management of diabetes mellitus.

Primary care practitioners face many challenges, however one of the greatest challenges is assisting patients in altering long-term behaviors that pose a threat to their health. On a general consensus, when patients are given advice on adapting healthier lifestyles that require a decrease or complete discontinuation of the harmful behaviors, they are normally frustrated and react to it negatively. A medical clinician, when faced with such resistance, will attempt yet again to try to give health advice and try to convince the patient to follow this advice. If the patient is still indifferent in the approach to the health risks associated with some lifestyle habits, the medical clinician may characterize this patient as being unmotivated.

Research that has been done to investigate behavioral changes has shown that motivation may be considered an active state that may be influenced. This influence on motivation may vary according to the style of the clinician. It has been noted that more resistance on the part of the patient may result due to a paternalistic or authoritative therapeutic style.

Diabetes mellitus has become a global epidemic and, for that reason, all health clinicians and other interdisciplinary professionals involved in patient care outcomes will need to pay close attention to therapy types and styles, which may be helpful to prevent disease onset. Recent data has shown that by utilizing those interventions that promote therapeutic lifestyle changes,

also referred to as TLC, there will be a decrease in the incidence of diabetes mellitus type II. These therapeutic lifestyle changes will include weight reduction, ongoing contact with a life coach, healthy diet and exercise. The *Diabetes Prevention Program* [<https://www.niddk.nih.gov/about-niddk/research-areas/diabetes/diabetes-prevention-program-dpp/Pages/default.aspx>] has released data that shows that the TLC activities are more beneficial in the prevention of diabetes mellitus than traditional pharmacologic therapy.

### **Resistance to Behavioral Change**

There are two forms of resistance that may have a hindering impact on making changes in behavior. The first of these two forms of resistance is related to the problem itself; and, the second will be related to the relationship between the patient and the health clinician. As it relates to the problem that is at hand, there may be some level of conflict in the perception of the patient of their behavior or lifestyle choice and that of society. Patients with diabetes mellitus that may also have a drug or alcohol problem may not be able to see the problem with their behavior and will therefore need some level of coercion in order to change this behavior. It is normal human instinct to be resistant to any form of restraint, especially as it pertains to lifestyle choices. This resistance is therefore not seen as unusual.

The other form of resistance is that which arises based on the patient-health clinician relationship and is usually based on the patient's perception to authority or the values about the rights of individuals. Patients which have been observed to be inclined to both forms of resistance have a higher than normal level of aggression, anger and impulsivity. Those patients with a need for control and that have a high level of avoidance will also be prone

to resistance. Resistance that is reflective of anger has been observed to cause a lack of progress in behavioral changes.

Motivational interviewing is clearly focused on resistance, which may arise in therapy. Within the practice of motivational interviewing, there are particular techniques that may be used in order to decrease the level of resistance of a patient. These techniques are all variations of insightful listening such as *amplified reflection*. In amplified reflection, the patient's resistance as well as their negative position toward change is emphasized. This method is based on the assumption that the oppositional propensity of the patient will cause them to make a withdrawal to the middle ground. Another approach that is often used is the *double-sided reflection*. In this approach, the ambivalence of the patient is highlighted. The main emphasis of this approach is on the patient's independence in the matter of making a change.

### **Establishing a Partnership**

The practice of motivational interviewing is more focused on exploration rather than on exhortation. In the same way, motivational interviewing is less focused on persuasion and argument and more focused on support. What this means is that motivational interviewing is intended to address the exploration and challenge a behavior change through the development of a positive relationship with the patient. This practice does not involve dictating to the patient what must be done or demanding any changes.

A good rapport between medical professionals and patients may be established when a nonjudgmental approach is taken. A genuine concern for the patient's well being is a key factor to establish a partnership with the patient. The patient must be allowed to set the agenda as well as be allowed

to ask all the necessary questions. For a patient with diabetes mellitus, this rapport may be used to illustrate the complications and risk of the disease. It is a sign of respect for the patient when they are allowed to talk and share opinions.

By asking *open-ended questions*, a gateway is made to gain more information and for emotions to be brought to the surface. Reflective listening will indicate to the patient that what is being expressed is being received. Making a summary of all that has been said and relaying it to the patient may also achieve this. As the relationship develops, the main point of focus should be to elicit *change talk*. In diabetes mellitus, for example, the main area of discussion with a patient may be on weight risks and for either developing or experiencing complications of the disease.

Before a partnership can be established, however, the patient may present with some resistance. There are many forms in which resistance may come. These forms may include, arguing, blaming, interrupting, excusing, ignoring, challenging and negating. In motivational interviewing, this resistance must not be faced directly with opposition but rather must be understood and dealt with in a timely manner. If a patient's resistance is immediately met with confrontation, additional barriers may be created and change will be more difficult to achieve.

The resistance presented by the patient should be viewed as a normal reaction rather than as a negative outcome. When a patient's first reaction to change is resistance, it may simply be an indication that the patient is unable to face the information that has been provided to them or does not believe it at all. The health clinicians and/or health team's responsibility is therefore to provide all possible alternatives and information that is

important to the patient's case in particular. When the resistance is addressed, the patient may be more inclined to make changes after a period of time. Clinicians should be keen to avoid all possibilities of an argument with the patient. With resistance already being an issue, confrontation will only result in a defensive reaction and an increase in the patient's resistance to change.

The success of motivational interviewing relies to a great extent on the relationship that is established between the patient and the health clinician. It is for this reason that it is essential there is an ability on the part of the clinician to express empathy during the process. In order to fully express empathy, clinicians must be skillful and employ reflective listening in order to relate to the patient's emotions. There will be a need to be understanding of the patient's perspective and not approach these perspectives with blame, judgment or criticism. By showing an attitude of respect and acceptance, this will contribute to the development of a helpful and effective relationship between the patient and clinician. This will also enhance the self-esteem of the patient. When health clinicians respond with empathy to patients, this will demonstrate that there is a clear understanding of their points of view, and that establish an essential basis for engaging the patient in suggestions for change.

Empathy will involve looking at the situation at hand from the perspective of the patient and thinking about things in the same way as a patient would. When clinicians share in the experience of the patient, this will allow the patient to be open with others about their experience as well. In diabetes mellitus in particular, this may mean that the patient will encourage changes in other family members who may also be susceptible to the onset of the disease. Through expressing empathy, clinicians are able to build a



relationship with patients and determine when and where patients will require the most assistance in managing lifestyle changes.

Establishing a partnership with the patient is an essential principle of motivational interviewing. When a patient observes that the health clinician is more of a friend than a foe, they will be more comfortable in expressing feelings of ambivalence. A patient's progress to change is greatly facilitated by the support of the health clinician and health team.

### **Listening to the Patient**

One of the main points to consider in motivational interviewing is that the primary solution for dealing with medical conditions such as diabetes mellitus is the patient rather than the disease itself. In order to get the patient to take on the responsibility of making lifesaving changes and altering their lifestyle, they will need to consider themselves an active participant in the interactions between themselves and the clinician.

Motivational interviewing will employ the general concept of *elicit and provide*. This is an ongoing process as information is being obtained from the patient, who will help the clinician to better understand the beliefs, readiness to change, attitudes and values of the patient. The clinician will be able to have a better understanding of what the patient is trying to convey by using reflective listening skills and asking the patient for additional information to clarify when necessary. This attentive relationship will also help to build a partnership with the patient as well as develop empathy.

The information that is obtained from the patient may also be used to help enhance discrepancy. When the health clinician has successfully obtained a good amount of information, information should then be passed back to the

patient based on the information elicited in order to close any knowledge gap. It is a sign of respect on the health clinician's part when permission is asked to convey this additional information to the patient. This will avoid having the patient feel as though the information is an imposition. When the health clinician has given all the necessary information to the patient, the patient should then be asked to express what was gathered from the new information. The clinician should also ask the patient's feelings on the new information. This will help to identify any questions or concerns that the patient may have of any of the information that was presented.

### **Identifying and Resolving Ambivalence**

In motivational interviewing, the principle of developing discrepancy is based on the belief that a patient may be motivated to change if the discrepancies between the essential lifestyle goals and the present behavior are highlighted. Making an identification of the patient's personal goals and clarifying these as well mostly help to accomplish this. The goals that are set should be those of the patient and not of the health clinician. If the goals are that of the health clinician, the patient may feel as though they are being forced and may become resistant to the change.

One of the most important objectives in motivational interviewing is assisting the patient in identifying and resolving any ambivalence that may be present between the intended goal and the current behavior. There are various techniques that may be utilized in order to identify and address ambivalence. One of the commonly used techniques is to inquire what it is that the patient views as positive or good about a particular behavior as well as asking what the patient's view is regarding the bad or negative aspects of the same behavior. By reflecting on both the positives and negatives, the discrepancy will emerge. If motivational interviewing is skillfully done, the

patient's views and behaviors towards change may be altered without the feeling of be coerced or pressured into this change.

### **Emphasizing Patient Autonomy**

One of the main principles and perhaps one of the most important is emphasizing autonomy. This is the patient's belief that they will be able to carry out or achieve a goal on their own, that is, without the assistance of the health clinician. The general goal is to enhance the confidence of the patient in their ability to overcome obstacles that may arise and to be successful in making a change. A health clinician may support independence further when small progresses in behavioral change that are made by the patient are recognized. This recognition should be given even if the patient is only attempting to make the changes but has not yet attained them. Simple supportive statements may just be the drive that the patient needs to embark on the journey on their own confidently. This may be something as simple as saying to the patient: *"It's good to know you have an interest in getting more information on diabetes."*

When the goals that are set for the patient are easily understood and actually attainable, this will inspire the patient further to want to accomplish the goal. An example would be a patient who is overweight and is physically inactive that may feel motivated even if the goal is to exercise for ten minutes twice a week. This will be considered a step in the right direction for the patient. Accomplishing this goal will inspire them to want to increase the level of activity and to succeed in carrying out other goals. It is also very essential that the health clinician also believe that the patient is able to reach the goal that has been set. The belief in the patient may have a powerful impact on the outcome. As stated previously, the patient's confidence in being able to carry out whatever goal has been set is an

important source of motivation to succeed in change. A patient must be given the responsibility of choosing the goals and carrying out the actions that are important for change according to the motivation interviewing approach. The duty of the health clinician and team is to focus all efforts on continuously motivating the patient towards this change. The clinician using motivational principles to effect change must be supportive of the patient's sense of independence.

One of the best ways to motivate a patient is by pointing out that there is no right way to change. If the initial plan for change does not work, changes may be made to the plan itself. The patient should be motivated to use his or her own creativity to solve the issue of amending the plan. The confidence and desire for change can be fostered by the health clinician by asking such questions as what new changes has been made, what progress has been made on a goal and what healthy choice the patient opted for instead of a previous behavior. Other success stories of previous patients in changing their lifestyle may be used as a means of motivating the patient. Knowing that it has been 'tried and proven' has been observed to be a point of motivation for many patients.

Impaired glucose tolerance (IGT) and impaired fasting glycaemia (IFG) are the strongest predictors of the development of diabetes mellitus type II. In order to prevent the growth of the diabetes mellitus epidemic, interventions must be made for patients at risk in the delay and possible prevention of the disease. There has been strong evidence to support that therapeutic lifestyle changes play a role in this delay. Health clinicians are in the best position to identify those patients that are at risk of developing diabetes mellitus. They can also utilize the motivational interviewing approach as a means of engaging the patient and to get them on the path to behavioral change. As

experience is gained in clinical care of the diabetic patient, a level of competence in clinicians' approach will also be achieved. Efforts made by all members of the diabetic clinical care team to help close the gap and effect change are needed to help overcome the diabetes mellitus epidemic.

### **Summary**

Diagnostic testing and medical management of diabetes as well as motivational interviewing to support change that reduces progression of the disease and further complications has been explored in this study. The importance of testing and the main three testing methods emphasized are Fasting Plasma Glucose, Casual Plasma Glucose and Glycated Hemoglobin (HbA1c). When testing is done for the diagnosis of diabetes mellitus and a positive result is obtained, repeat testing must be done for a conclusive diagnosis. When diagnosis is done and the patient is found to have the disease, the patient must be educated and engaged in the medical management of diabetes.

The treatment methods for diabetes may be in the form of insulin, metformin or other medications. The role of diet and other healthy lifestyle choices cannot be over-emphasized as primary to successful prevention and treatment of diabetes. In order for diabetic patients to make lifestyle changes to effectively manage diabetes, health clinicians can utilize the approach of motivational interviewing. In this approach clinicians establish partnership, listen to the patient, identify and resolve ambivalence and emphasize autonomy. Lifestyle management as well as the surgical treatment of diabetes mellitus have not been discussed here, however, the learner is recommended to courses addressing those options in the treatment of diabetes, which include smoking cessation, the relationship between body weight and diabetes, more on how dietary changes help to

reduce the blood glucose level, as well as the possibility of pancreatic transplants and gastric bypass.

Everyday there is new research in the field of endocrinology and diabetes in particular that influences how diabetic treatment teams and primary care clinicians develop their approach to treat and manage patient treatment plans. This course also reviewed comorbid conditions and complications of diabetes that are undergoing new hope and change in prevention and treatment strategies that will impact how medical management and outcomes for all age groups and special situations involving diabetic patients, such as during pregnancy, evolve.

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**Completing the study questions is optional and is NOT a course requirement.**

**1. What reading is indicative of diabetes mellitus in a casual plasma glucose test?**

- a. 200m/dl
- b. 100mg/dl
- c. 300mg/dl
- d. 0mg/dl

**2. The use of self-management is most suitable for patients with \_\_\_\_\_ who use insulin therapy and regulate their dosage as a result of blood glucose testing.**

- a. diabetes mellitus type I or type II
- b. diabetes mellitus type I only
- c. gestational diabetes
- d. pre-diabetes

**3. In rare cases, metformin may cause a condition known as**

- a. Kussmaul breathing.
- b. hypoglycemia.
- c. lactic acidosis.
- d. hyperglycemia.

**4. Thiazolidinediones are used to enhance the action of insulin in the body in the**

- a. pancreas and beta cells.
- b. fat and muscles.
- c. pancreas and liver.
- d. liver and kidney.

**5. The *practice* of “motivational interviewing” came around as a result of**

- a. a series of seminars.
- b. a paper by Dr. Ray Hodgson
- c. clinical practice.
- d. All of the above

**6. True and False: Blood tests are used to diagnose diabetes mellitus because there are little or no symptoms associated with type II diabetes in the initial onset of the disease.**

- a. True
- b. False

**7. Before taking a fasting plasma glucose test, the patient cannot eat for \_\_\_\_\_.**

- a. an hour
- b. 12-14 hours
- c. a day
- d. 2 hours

**8. Glycated hemoglobin is found in the \_\_\_\_\_.**

- a. beta cells
- b. pancreas
- c. kidney
- d. red blood cells

**9. Resistance to change may be related to healthcare clinician-patient interaction or the \_\_\_\_\_ itself.**

- a. change
- b. approach
- c. problem
- d. goal

**10. The following is a principle of Motivational Interviewing:**

- a. Emphasizing autonomy
- b. Listening to the patient
- c. Establishing partnership
- d. All of the above

**11. True and False: Two patients that have the same average blood sugar will have identical HbA1c values.**

- a. True
- b. False



- 12. When a patient is allowed to make an attempt at achieving a goal on their own, this follows the principle of**
- a. emphasizing autonomy.
  - b. listening to the patient.
  - c. establishing partnership.
  - d. identifying and reducing ambivalence.
- 13. After a period of prolonged fasting, the pancreas releases**
- a. insulin.
  - b. glucose.
  - c. the hormone glucagon.
  - d. HbA1c.
- 14. The presence of the hormone glucagon in the bloodstream initiates the release of glucose into the bloodstream from the liver.**
- a. the liver.
  - b. the pancreas.
  - c. the thymus.
  - d. the pituitary gland.
- 15. In a healthy person, the release of glucose into the bloodstream triggers the production of**
- a. the hormone glucagon.
  - b. HbA1c.
  - c. fast-acting carbohydrate.
  - d. insulin.
- 16. True and False: The use of self-management is most suitable for patients with diabetes mellitus type I or type II who use insulin therapy and regulate their dosage as a result of blood glucose testing.**
- a. True
  - b. False

**17. Insulin therapy is recommended for patients with an HbA1c level that is**

- a. greater than 15%.
- b. below 8%.
- c. equal or below 8%.
- d. greater than 9%.

**18. Insulin is continuously secreted by \_\_\_\_\_ in a manner that is glucose dependent throughout the course of the day.**

- a. the hormone glucagon
- b. the glycated hemoglobin cells
- c. the liver
- d. the beta cells

**19. Insulin released in the *first phase* will suppress**

- a. the hormone glucagon.
- b. the hepatic glucose production.
- c. oral carbohydrate loads.
- d. beta cell activity.

**20. Diabetes mellitus type II is commonly associated with an insulin resistance and**

- a. HbA1C levels of 9% or below.
- b. a gradual failure of hepatic glucose production.
- c. a gradual failure of the beta cells.
- d. a complete cessation of beta cell activity.

**21. In patients diagnosed with diabetes mellitus type II, the rate of the beta cell depletion will continue at a rate of**

- a. less than 1% per year.
- b. 2% per month.
- c. 4% per year.
- d. 10% per year.

**22. The best points for administering insulin include**

- a. the front of the arm.
- b. in the outer thigh.
- c. the back of the hand.
- d. the bicep.

**23. When the insulin is being injected, the needle must be**

- a. held at a 90-degree angle to the skin.
- b. held at a 45-degree angle to the skin.
- c. withdrawn immediately after insulin is injected.
- d. administered by a healthcare clinician.

**24. True and False: After being injected with the insulin, the needle has to be held in place for ten seconds in order to prevent the insulin from leaking out.**

- a. True
- b. False

**25. In order to prevent the occurrence of \_\_\_\_\_, which is the scarring of tissue from repeated injection at the same place, the injecting point must be rotated.**

- a. lipohypertrophy
- b. an antilipolytic effect
- c. postprandial hyperglycemia
- d. macrovascular complications

**26. If lipohypertrophy occurs, this will lead to poor absorption of insulin as well as depot formation, which may directly cause**

- a. beta cell depletion.
- b. an antilipolytic effect.
- c. phase 2 insulin release.
- d. the random release of insulin.

**27. The advantage of using an insulin pen to inject insulin is that**

- a. insulin may be injected at any angle.
- b. it must be refrigerated.
- c. it is usable by a patient who is visually impaired.
- d. it does not need to be primed.

**28. The American Diabetes Association (ADA) has recommended that if hypoglycemia is suspected and confirmed, it must be treated with**

- a. exercise.
- b. an insulin injection.
- c. a fast-acting carbohydrate.
- d. fasting.

**29. Adverse effects of insulin therapy may include**

- a. weight gain.
- b. decreased appetite.
- c. phase 2 insulin release.
- d. hyperglycemia.

**30. A clinician should consider patient resistance to medical management an *abnormal response* and terminate diabetic treatment because the patient is not interested in change.**

- a. True
- b. False

**CORRECT ANSWERS:**

**1. What reading is indicative of diabetes mellitus in a casual plasma glucose test?**

a. 200m/dl

*"If the results obtained from this test gives a result of 200 mg/dl or higher, this is indicative of a likely diagnosis of diabetes mellitus."*

**2. The use of self-management is most suitable for patients with \_\_\_\_\_ who use insulin therapy and regulate their dosage as a result of blood glucose testing.**

a. diabetes mellitus type I or type II

*"The use of self-management is most suitable for patients with diabetes mellitus type I or type II who use insulin therapy and regulate their dosage as a result of blood glucose testing."*

**3. In rare cases, metformin may cause a condition known as**

c. lactic acidosis.

*"In rare cases, metformin will cause a very serious and sometimes fatal condition known as lactic acidosis."*

**4. Thiazolidinediones are used to enhance the action of insulin in the body in the**

b. fat and muscles.

*"This medication is often referred to as TZDs and is used to enhance the action of the insulin in the body in fat and muscle."*

**5. The *practice* of "motivational interviewing" came as a result of**

d. clinical practice.

*"The practice of motivational interviewing came as a result of clinical practice."*

**6. True and False: Blood tests are used to diagnose diabetes mellitus because there are little or no symptoms associated with type II diabetes in the initial onset of the disease.**

a. True

*"In pre-diabetic states and diabetes mellitus diagnosis is done through blood testing. This method is used due to the fact that there are little or no symptoms associated with type II diabetes in the initial onset of the disease."*

**7. Before taking a fasting plasma glucose test, the patient cannot eat for \_\_\_\_\_.**

b. 12-14 hours

*"The fasting plasma glucose test: Before being tested, a patient is required to refrain from eating for a period of 12 to 14 hours."*

**8. Glycated hemoglobin is found in the \_\_\_\_\_.**

d. red blood cells

*"Red blood cells are constituted of a molecule known as hemoglobin. With glycated hemoglobin, the glucose will be attracted to, and attach to, the hemoglobin that results in another molecule, which is referred to as the hemoglobin A1c or HbA1c."*

**9. Resistance to change may be related to health clinician-patient interaction or the \_\_\_\_\_ itself.**

c. problem

*"The first of these two forms of resistance is related to the problem itself; and, the second will be related to the relationship between the patient and the clinician."*

**10. The following is a principle of Motivational Interviewing:**

- a. Emphasizing autonomy
- b. Listening to the patient
- c. Establishing partnership
- d. All of the above [*correct answer*]

*"In this approach the healthcare clinician will establish partnership, listen to the patient, identify and resolve ambivalence and emphasize autonomy."*

**11. True and False: Two patients that have the same average blood sugar will have identical HbA1c values.**

- b. False

*"Two patients that have the same average blood sugar may have HbA1c values differing by an amount of up to 3 percentage points."*

**12. When a patient is allowed to make an attempt at achieving a goal on their own, this follows the principle of**

- a. emphasizing autonomy.

*"One of the main principles and perhaps one of the most important is emphasizing autonomy. This is the patient's belief that they will be able to carry out or achieve a goal on their own, that is, without the assistance of the health clinician."*

**13. After a period of prolonged fasting, the pancreas releases**

- c. the hormone glucagon.

*"The fasting plasma glucose test, After a period of prolonged fasting, there will be a triggering of the hormone glucagon; this is the hormone that is produced by the pancreas. This will initiate the release of glucose into the bloodstream from the liver."*

**14. The presence of the hormone glucagon in the bloodstream initiates the release of glucose into the bloodstream from the liver.**

a. the liver.

*"The fasting plasma glucose test, After a period of prolonged fasting, there will be a triggering of the hormone glucagon; this is the hormone that is produced by the pancreas. This will initiate the release of glucose into the bloodstream from the liver."*

**15. In a healthy person, the release of glucose into the bloodstream triggers the production of**

d. insulin.

*"The fasting plasma glucose test, After a period of prolonged fasting, there will be a triggering of the hormone glucagon; this is the hormone that is produced by the pancreas. This will initiate the release of glucose into the bloodstream from the liver. The expected reaction from the body is to produce insulin which will prevent the onset of high blood sugar, hyperglycemia."*

**16. True and False: Insulin may also be prescribed if the disease is uncontrolled even after oral glycemic therapy.**

a. True

*"Insulin may also be prescribed if the disease is uncontrolled even after oral glycemic therapy."*

**17. Insulin therapy is recommended for patients with a HbA1c level that is**

d. greater than 9%.

*"The treatment of diabetes mellitus through the therapy of insulin is recommended for patients that have diabetes mellitus type II or HbA1c level that is greater than 9%."*



**18. Insulin is continuously secreted by \_\_\_\_\_ in a manner that is glucose dependent throughout the course of the day.**

d. the beta cells

*"Insulin is continuously secreted by the beta cells in a manner that is glucose dependent throughout the course of the day."*

**19. Insulin released in the *first phase* will suppress**

b. the hepatic glucose production.

*"This includes a first phase insulin release, which will suppress the hepatic glucose production. After this a slower second phase release of insulin will occur and will cover the carbohydrates that have been ingested."*

**20. Diabetes mellitus type II is commonly associated with an insulin resistance and**

c. a gradual failure of the beta cells.

*"Diabetes mellitus type II is commonly associated with an insulin resistance and a gradual failure of the beta cells."*

**21. In patients diagnosed with diabetes mellitus type II, the rate of the beta cell depletion will continue at a rate of**

c. 4% per year.

*"When the disease is diagnosed in patients with type II, a good percentage of the beta cells have already been depleted and are not functioning the way that they should. The rate of the beta cell depletion will continue at a rate of 4% per year."*

**22. The best points for administering insulin include**

b. in the outer thigh.

*"Insulin will only prove to be effective in a patient when it is correctly administered. The best points for administering the insulin are in the outer thigh, the abdomen, the buttocks or the back of the arm."*

**23. When the insulin is being injected, the needle must be**

- a. held at a 90-degree angle to the skin.

*"When the insulin is being injected, the needle must be held at a 90-degree angle to the skin."*

**24. True and False: After being injected with the insulin, the needle has to be held in place for ten seconds in order to prevent the insulin from leaking out.**

- a. True

*"After being injected with the insulin, the needle has to be held in place for ten seconds in order to prevent the insulin from leaking out."*

**25. In order to prevent the occurrence of \_\_\_\_\_, which is the scarring of tissue from repeated injection at the same place, the injecting point must be rotated.**

- a. lipohypertrophy

*"In order to prevent the occurrence of lipohypertrophy, which is the scarring of tissue from repeated injection at the same place, the injecting point must be rotated."*

**26. If lipohypertrophy occurs, this will lead to poor absorption of insulin as well as depot formation, which may directly cause**

- d. the random release of insulin.

*"If lipohypertrophy occurs, this will lead to poor absorption of insulin as well as depot formation, which may lead to the random release of insulin."*

**27. The advantage of using an insulin pen to inject insulin is that**

- c. it is usable by a patient who is visually impaired.

*"The advantage of using an insulin pen is that ... It is also very easy to use if the patient is visually impaired or has problems with dexterity. For those patients who suffer from no or poor vision, the pen's clicks will give an account of the number of units."*

**28. The American Diabetes Association (ADA) has recommended that if hypoglycemia is suspected and confirmed, it must be treated with**

- c. a fast-acting carbohydrate.

*"The American Diabetes Association (ADA) has recommended that once hypoglycemia is suspected, that there be a blood glucose check done. If it is hypoglycemia, it must be treated with a fast-acting carbohydrate, which may be in the form of a glucose tablet or a juice."*

**29. Adverse effects of insulin therapy may include**

- a. weight gain.

*"Due to the anabolic effects of insulin, a patient may also experience some level of weight gain. The insulin may increase the appetite and cause defensive eating to fight against the effects of the hypoglycemia."*

**30. A clinician should consider patient resistance to medical management an abnormal response and terminate diabetic treatment because the patient is not interested in change.**

- a. True
- b. False

*"The resistance presented by the patient should be viewed as a normal reaction rather than as a negative outcome."*

## References Section

The References below include published works and in-text citations of published works that are intended as helpful material for your further reading.

1. Symptoms 2013. American Diabetes Association. Retrieved online at <http://www.diabetes.org/diabetes-basics/symptoms/?print=t>
2. Am I at risk for type 2 diabetes? 2012 National Institute of Diabetes and Digestive and Kidney Disease. Retrieved online at <http://diabetes.niddk.nih.gov/dm/pubs/riskfortype2/index.aspx#3>
3. Unexplained weight loss 2013. Diabetes.co.uk. Retrieved online at <http://www.diabetes.co.uk/symptoms/unexplained-weight-loss.html>
4. Unexplained weight loss 2013. Diabetes.co.uk. Retrieved online at <http://www.diabetes.co.uk/symptoms/unexplained-weight-loss.html>
5. Horton E. S, Silberman C, Davis K, Berria Weight Loss, Glycemic Control, and Changes in Cardiovascular Biomarkers in Patients With Type 2 Diabetes Receiving Incretin Therapies or Insulin in a Large Cohort Database. *Diabetes Care*. 2010 August; 33(8): 1759–1765. Retrieved online at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2909058/>
6. McCulloch, D.K. (2016). Classification of diabetes mellitus and genetic diabetic syndromes. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/classification-of-diabetes-mellitus-and-genetic-diabetic-syndromes?source=search\\_result&search=diabetes&selectedTitle=6~150](https://www.uptodate.com/contents/classification-of-diabetes-mellitus-and-genetic-diabetic-syndromes?source=search_result&search=diabetes&selectedTitle=6~150)
7. Poudel, R.R. (2013). Renal glucose handling in diabetes and sodium glucose cotransporter 2 inhibition. *Indian J. Endocrinol Metab*. 2013 Jul-Aug; 17(4):588-593. Retrieved online at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3743357/>
8. Levitsky, Lynne and Misra, M. (2016). Epidemiology, presentation, and diagnosis of type 1 diabetes mellitus in children and adolescents. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/epidemiology-presentation-and-diagnosis-of-type-1-diabetes-mellitus-in-children-and-adolescents?source=search\\_result&search=diabetes%20in%20children&selectedTitle=1~150](https://www.uptodate.com/contents/epidemiology-presentation-and-diagnosis-of-type-1-diabetes-mellitus-in-children-and-adolescents?source=search_result&search=diabetes%20in%20children&selectedTitle=1~150).
9. McCulloch, D. (2016). Overview of medical care in adults with diabetes mellitus. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/overview-of-medical-care-in-adults-with-diabetes-mellitus?source=search\\_result&search=diabetes&selectedTitle=1~150](https://www.uptodate.com/contents/overview-of-medical-care-in-adults-with-diabetes-mellitus?source=search_result&search=diabetes&selectedTitle=1~150).

10. Mason PE, Lerbret A, Saboungi ML, Neilson GW, Dempsey CE, Brady JW. Glucose interactions with a model peptide Proteins. 2011 Jul;79(7):2224-32. doi: 10.1002/prot.23047. Epub 2011 May 13. Retrieved online at <http://www.ncbi.nlm.nih.gov/pubmed/21574187>
11. Polydipsia 2013. Genetics Home Reference. Retrieved online at <http://ghr.nlm.nih.gov/glossary=polydipsia>
12. Increased thirst-polydipsia- excessive thirst 2013. PubMed Health. Retrieved online at <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0003574/>
13. McCulloch, D.K. and Hayward, R. (2016). Screening for type 2 diabetes mellitus. Retrieved online at [https://www.uptodate.com/contents/screening-for-type-2-diabetes-mellitus?source=search\\_result&search=normal%20blood%20sugar&selectedTitle=1~150](https://www.uptodate.com/contents/screening-for-type-2-diabetes-mellitus?source=search_result&search=normal%20blood%20sugar&selectedTitle=1~150)
14. Hirsch, B. and Emmett, M. (2016). Diabetic ketoacidosis and hyperosmolar hyperglycemic state in adults: Treatment. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/diabetic-ketoacidosis-and-hyperosmolar-hyperglycemic-state-in-adults-treatment?source=search\\_result&search=dka&selectedTitle=1~150](https://www.uptodate.com/contents/diabetic-ketoacidosis-and-hyperosmolar-hyperglycemic-state-in-adults-treatment?source=search_result&search=dka&selectedTitle=1~150).
15. Zhou, B., *et al* (2016). Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants. *The Lancet*. Volume 387, No. 10027, p1513–1530, 9 April 2016. Retrieved online at [http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(16\)00618-8/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(16)00618-8/fulltext).
16. Berthoud H. R, Lenard N. R, Shin A. C. Food reward, hyperphagia, and obesity. 2011 *Am J Physiol Regul Integr Comp Physiol* 300 (6): R1266–77. doi:10.1152/ajpregu.00028.2011. PMC 3119156. PMID 21411768.
17. Polyphagia 2013. Diabetes.co.uk. Retrieved online at <http://www.diabetes.co.uk/symptoms/polyphagia.html>
18. Elliott R. E, Jane J. A, Wisoff J. H. Surgical management of craniopharyngiomas in children: meta-analysis and comparison of transcranial and transsphenoidal approaches. 2011 *Neurosurgery* 69 (3): 630–43; discussion 643. doi:10.1227/NEU.0b013e31821a872d. PMID 21499159.
19. Diabetes symptoms: When diabetes symptoms are a concern 2013. Mayo Clinic. Retrieved online at <http://www.mayoclinic.org/diseases-conditions/diabetes/in-depth/diabetes-symptoms/ART-20044248>
20. Prevent diabetes problems: Keep your eyes healthy 2013. NDIC. Retrieved online at [http://diabetes.niddk.nih.gov/dm/pubs/complications\\_eyes/index.aspx?control=pdf](http://diabetes.niddk.nih.gov/dm/pubs/complications_eyes/index.aspx?control=pdf)

21. Cataracts defined- what is a cataract? 2009. National Eye Institute. Retrieved online at [http://www.nei.nih.gov/health/cataract/cataract\\_facts.asp](http://www.nei.nih.gov/health/cataract/cataract_facts.asp)
22. Skin complications 2013. American Diabetes Association. Retrieved online at <http://www.diabetes.org/living-with-diabetes/complications/skin-complications.html>
23. CDC (2015). Number (in Millions) of Civilian, Non-Institutionalized Persons with Diagnosed Diabetes, United States, 1980-2014. Retrieved online at <https://www.cdc.gov/diabetes/statistics/prev/national/figpersons.htm>.
24. Acanthosis Nigricans 2012. Mayo Clinic. Retrieved online at [www.mayoclinic.org/diseases-conditions/acanthosis-nigricans/basics/definition/CON-20025600](http://www.mayoclinic.org/diseases-conditions/acanthosis-nigricans/basics/definition/CON-20025600)
25. Sunil Kumar Kota, Sruti Jammula, Siva Krishna Kota, Lalit Kumar Meher, Kirtikumar D. Modi Necrobiosis lipoidica diabetorum: a case based review of literature 2012. *Indian J Endocrinol Metab.* 2012 Jul-Aug; 16(4): 614-620. doi: 10.4103/2230-8210.98023
26. Diabetic Blisters 2013. DiabetesCare.net. Retrieved online at [http://www.diabetescare.net/content\\_detail.asp?id=813](http://www.diabetescare.net/content_detail.asp?id=813)
27. Eruptive Xanthomatosis 2013. DiabetesCare.net Retrieved online at [http://www.diabetescare.net/content\\_detail.asp?id=825](http://www.diabetescare.net/content_detail.asp?id=825)
28. Thick Skin 2013. DiabetesCare.net. Retrieved online at [http://www.diabetescare.net/content\\_detail.asp?id=816](http://www.diabetescare.net/content_detail.asp?id=816)
29. Kher, K. and Sharron, M. (2016). Approach to the child with metabolic acidosis. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/approach-to-the-child-with-metabolic-acidosis?source=search\\_result&search=kussmaul%20breathing&selectedTitle=4~12](https://www.uptodate.com/contents/approach-to-the-child-with-metabolic-acidosis?source=search_result&search=kussmaul%20breathing&selectedTitle=4~12).
30. Respiratory system and diabetes-ketoacidosis and Kussmaul breathing 2013 Diabetes.co.uk. Retrieved online at <http://www.diabetes.co.uk/body/respiratory-system.html>
31. Diabetes Ketoacidosis 2012. Mayo Clinic. Retrieved online at <http://www.mayoclinic.org/diseases-conditions/diabetic-ketoacidosis/basics/symptoms/CON-20026470> Accessed December 21, 2013
32. Gastroparesis- What is Gastroparesis? 2012. NDDIC. Retrieved online at <http://digestive.niddk.nih.gov/ddiseases/pubs/gastroparesis/>
33. Gastroparesis 2012. Mayo Clinic. Retrieved online at <http://www.mayoclinic.org/diseases-conditions/gastroparesis/basics/definition/CON-20023971>
34. Gastroparesis 2012. American Diabetes Association. Retrieved online at <http://www.diabetes.org/living-with-diabetes/complications/gastroparesis.html>

35. Gastroparesis- Introduction 2012. NHS. Retrieved online at <http://www.nhs.uk/conditions/gastroparesis/Pages/Introduction.aspx>
36. Complications 2013. American Diabetes Association. Retrieved online at <http://www.diabetes.org/living-with-diabetes/complications/?loc=symptoms>
37. Diabetes, heart disease and stroke: What is the connection between diabetes, heart disease and stroke? 2013. National Institute of Diabetes and Digestive and Kidney Disease. Retrieved online at [diabetes.niddk.nih.gov/dm/pubs/stroke/index.aspx](http://diabetes.niddk.nih.gov/dm/pubs/stroke/index.aspx)
38. Diabetic Ketoacidosis 2013. PubMed Health. Retrieved online at <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001363/>
39. Ketoacidosis (DKA) 2013. American Diabetes Association. Retrieved online at <http://www.diabetes.org/living-with-diabetes/complications/ketoacidosis-dka.html>
40. Hyperosmolar Hyperglycemic Nonketotic Syndrome 2013. American Diabetes Association. Retrieved online at <http://www.diabetes.org/living-with-diabetes/complications/hyperosmolar-hyperglycemic.html>
41. Hyperosmolar nonketotic coma 2013. Department of Medicine NYU. Retrieved online at <http://medicine.med.nyu.edu/conditions-we-treat/conditions/hyperosmolar-nonketotic-coma>.
42. Cardiovascular disease and diabetes 2013. American Heart Association. Retrieved online at [http://www.heart.org/HEARTORG/Conditions/Diabetes/WhyDiabetesMatters/Cardiovascular-Disease-Diabetes\\_UCM\\_313865\\_Article.jsp](http://www.heart.org/HEARTORG/Conditions/Diabetes/WhyDiabetesMatters/Cardiovascular-Disease-Diabetes_UCM_313865_Article.jsp)
43. What is diabetic heart disease? 2011. National Heart, Lung and Blood Institution. Retrieved online at <http://www.nhlbi.nih.gov/health/health-topics/topics/dhd/>
44. The link between diabetes and cardiovascular disease. National Diabetes Educational Program. Retrieved online at [http://ndep.nih.gov/media/CVD\\_FactSheet.pdf](http://ndep.nih.gov/media/CVD_FactSheet.pdf)
45. Kidney Disease (Nephropathy) 2013. American Diabetes Association. Retrieved online at <http://www.diabetes.org/living-with-diabetes/complications/kidney-disease-nephropathy.html>.
46. Kidney Disease of Diabetes 2013. NKUDIC. Retrieved online at <http://kidney.niddk.nih.gov/kudiseases/pubs/kdd/>
47. Diabetes and Kidney Disease. National Kidney Foundation. Retrieved online at <http://www.kidney.org/atoz/content/diabetes.cfm>
48. Facts about diabetic retinopathy 2012. National Eye Institute. Retrieved online at <http://www.nei.nih.gov/health/diabetic/retinopathy.asp>
49. Eye complications 2013. American Diabetes Association. Retrieved online at <http://www.diabetes.org/living-with-diabetes/complications/eye-complications/>
50. Fong D.S, Aiello L, Gardner T.W, King G. L, Blankenship G, Cavallerano J.D, Ferris F.L Klein R. Retinopathy in Diabetes. American Diabetes

- Association- Diabetes Care. Retrieved online at [care.diabetesjournals.org/content/27/suppl\\_1/s84.full](http://care.diabetesjournals.org/content/27/suppl_1/s84.full)
51. Diabetic Neuropathies: The nerve damage of diabetes 2012. NDIC. Retrieved online at <http://diabetes.niddk.nih.gov/dm/pubs/neuropathies/>
  52. Autonomic Neuropathy 2013. American Diabetes Association. Retrieved online at <http://www.diabetes.org/living-with-diabetes/complications/neuropathy/autonomic-neuropathy.html>
  53. Diabetic Neuropathy-Symptoms 2012. Mayo Clinic. <http://www.mayoclinic.org/diseases-conditions/diabetic-neuropathy/basics/symptoms/con-20033336>
  54. Feldman, E. (2016). Clinical manifestations and diagnosis of diabetic polyneuropathy. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/clinical-manifestations-and-diagnosis-of-diabetic-polyneuropathy?source=search\\_result&search=diabetic%20neuropathy&selectedTitle=2~150](https://www.uptodate.com/contents/clinical-manifestations-and-diagnosis-of-diabetic-polyneuropathy?source=search_result&search=diabetic%20neuropathy&selectedTitle=2~150).
  55. Brands A.M, Biessels G.J, de Haan E.H, Kappelle L.J, Kessels R. P, The Effects of Type 1 Diabetes on Cognitive Performance- A meta-analysis. American Diabetes Association-Diabetes Care. Retrieved online at <http://care.diabetesjournals.org/content/28/3/726.full>
  56. Moore, E., et al (2013). Increased Risk of Cognitive Impairment in Patients With Diabetes Is Associated With Metformin. *Diabetes Care*. American Diabetes Association. Retrieved online at <http://care.diabetesjournals.org/content/early/2013/08/29/dc13-0229.abstract>.
  57. Ryan, J., Fine, D. and Rosano, C. (2014). Type 2 Diabetes and Cognitive Impairment. Contributions From Neuroimaging. *Geriatric Psychiatry and Neurology*. Retrieved online at <http://jgp.sagepub.com/content/early/2014/01/05/0891988713516543.abstract>.
  58. Trushna, T., et al (2013). A simple screening test with a potential to detect diabetic cognitive impairment in the geriatric population: a preliminary study. Department of Physiology, Kasturba Medical College, Manipal, India. Retrieved online at <http://www.med.cmb.ac.lk/SMJ/VOLUME%203%20DOWNLOADS/Page%2017-21%20-%20A%20simple%20screening%20test%20with%20a%20potential%20to%20detect%20diabetic%20cognitive%20impairment%20in%20the%20geriatric%20population%20-%20a%20preliminary%20study.pdf>.
  59. Coustan, Donald (2016). Gestational diabetes mellitus: Glycemic control and maternal prognosis. *UpToDate*. Retrieved online at <https://www.uptodate.com/contents/gestational-diabetes-mellitus-glycemic-control-and-maternal->



- prognosis?source=search\_result&search=gestational%20diabetes&selectedTitle=1~71.
60. Zhang, B, et al. (2014). The China Health and Nutrition Survey, 1989-2011. *Obes Rev.* 2014 Jan; 15(01). Retrieved online at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3869031/>.
  61. Coustan, D. (2016). Diabetes mellitus in pregnancy: Screening and diagnosis. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/diabetes-mellitus-in-pregnancy-screening-and-diagnosis?source=search\\_result&search=gestrational%20diabetes&selectedTitle=2~150](https://www.uptodate.com/contents/diabetes-mellitus-in-pregnancy-screening-and-diagnosis?source=search_result&search=gestrational%20diabetes&selectedTitle=2~150).
  62. Caughey, A. (2016). Gestational diabetes mellitus: Obstetrical issues and management. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/gestational-diabetes-mellitus-obstetrical-issues-and-management?source=search\\_result&search=gestrational%20diabetes&selectedTitle=6~150](https://www.uptodate.com/contents/gestational-diabetes-mellitus-obstetrical-issues-and-management?source=search_result&search=gestrational%20diabetes&selectedTitle=6~150).
  63. McCulloch (2016). Classification of diabetes mellitus and genetic diabetic syndromes. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/classification-of-diabetes-mellitus-and-genetic-diabetic-syndromes?source=search\\_result&search=MODY&selectedTitle=1~17](https://www.uptodate.com/contents/classification-of-diabetes-mellitus-and-genetic-diabetic-syndromes?source=search_result&search=MODY&selectedTitle=1~17).
  64. Sunehag, A. et al. (2016). Pathogenesis, clinical features, and diagnosis of persistent hyperinsulinemic hypoglycemia of infancy. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/pathogenesis-clinical-features-and-diagnosis-of-persistent-hyperinsulinemic-hypoglycemia-of-infancy?source=search\\_result&search=MODY&selectedTitle=3~17](https://www.uptodate.com/contents/pathogenesis-clinical-features-and-diagnosis-of-persistent-hyperinsulinemic-hypoglycemia-of-infancy?source=search_result&search=MODY&selectedTitle=3~17).
  65. Gardner, D and Shyong Tai, E. (2012). Clinical features and treatment of maturity onset diabetes. *Diabetes Metab Syndr Obes.* 2012; 5: 101–108.
  66. Lebow, Jay (2016). Overview of psychotherapies. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/overview-of-psychotherapies?source=search\\_result&search=prevention%20and%20motivational%20interviewing&selectedTitle=10~55](https://www.uptodate.com/contents/overview-of-psychotherapies?source=search_result&search=prevention%20and%20motivational%20interviewing&selectedTitle=10~55).
  67. Skelton, J. (2016). Management of childhood obesity in the primary care setting. *UpToDate*. Retrieved online at [https://www.uptodate.com/contents/management-of-childhood-obesity-in-the-primary-care-setting?source=search\\_result&search=prevention%20and%20motivational%20interviewing&selectedTitle=2~55](https://www.uptodate.com/contents/management-of-childhood-obesity-in-the-primary-care-setting?source=search_result&search=prevention%20and%20motivational%20interviewing&selectedTitle=2~55).
  68. Miller, W.R. (2017). Motivational Interviewing. Cener on Alcoholism, Substance Abuse and Addiction. The University of New Mexico. Retrieved online at <http://www.williamrmiller.net/MotivationalInterviewing.html>.

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