Quick Study HEALTH

Diabetes Care

Diabetes Mellitus the scope of the problem

Incidence & Prevalence

- More than **18 million** Americans have diabetes (13 million diagnosed)
  - **5 million** *do not even know* they have diabetes
  - Each year, at least 190,000 people die as a result of *diabetes or a related complication*

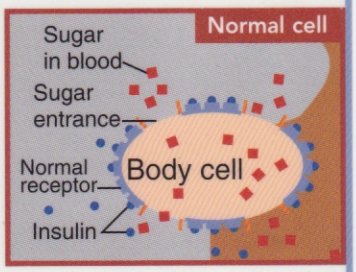
Historical Perspective of *Diabetes Mellitus*

- Diabetes is a serious disease that has been known for thousands of years and is described in the earliest medical writings, circa 1500 B.C.
- The Greek physician **Aretaeus of Cappadocia** (120–200 A.D.) first called the disease *diabetes,* which means to "syphon or flow through"; referring to the increased flow of urine; later, the Latin word *mellitus,* which means "honeyed," was added to indicate the presence of sugar in the urine
- In the 1860s, a German doctor named **Paul Langerhans** discovered the ***islets of Langerhans*** within the pancreas; it was later found that this is where insulin is produced, stored and released
- In the 1880s, the first really significant experiment occurred when **Oscar Minkowski** and **Joseph von Mering** discovered that, when the pancreas of a dog was removed, the animal began urinating more frequently, sugar appeared in the urine, and the animal eventually died
- A **major breakthrough** in the treatment of diabetes occurred in 1921 when a group of researchers isolated an extract that came from the islets cells of the pancreas and was first referred to as "isletin," but later became known as ***insulin***; **Dr. Frederick Grant Banting** received the Nobel Prize for medicine in 1923 for this discovery
- In the late 1940s and early 1950s, after World War II, extensive research resumed
- In the mid-1960s, the **American Diabetes Association (ADA)** found that laypersons, community leaders, and health-care agencies were not interested in diabetes; the perception was that diabetes was relatively uncommon and easy to manage, with very little effect on a person's life
- In 1974, Congress established a **National Diabetes Commission** to assess the personal and financial impact of diabetes; the results were:
  - At least **10 million** Americans had diabetes in 1974
  - Diabetes was the *5th leading* cause of **death** by disease at that time
  - Diabetes was the *leading* cause of **blindness** among people over age 20
  - People with diabetes were *twice* as likely as others to develop **heart disease** and suffer a **heart attack** or **stroke**
  - People with diabetes were *17 times* more prone to **kidney disease**
  - People with diabetes were *40 times* more likely to need **amputations**
  - The estimated *annual cost of diabetes* to the U.S. in 1975 was more than **$5 billion**
- Since this information was released, more than **3.6 million** *new cases* of diabetes have been detected, and the cost of the disease to the nation has risen to approximately **9.7 billion dollars** annually

Diabetes Mellitus defined

Review of Normal Body Function

- Sugar comes from 2 places – internal sugar comes from our body's own production in the liver and external sugar comes from the food we eat
- When the liver releases internal sugar, or external sugar is produced by digestion of food, the sugar enters the blood stream
- The **sugar** in the **blood** must enter the body cells before the cells can use it to produce energy
- Insulin, a substance released from the pancreas, helps the sugar leave the blood and go into the body cells; insulin has 2 functions:
  - Allows **sugar** (from external or internal production) to pass into **cells** where it can be used for *energy*
  - Shuts off excess internal sugar production in liver and muscle



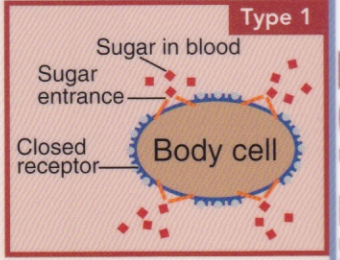
- The **sugar** can then be used as **fuel** for the **cells**; the level of sugar in the blood is reduced as the sugar goes from the blood into the cell
- Insulin acts like a "key" to allow sugar from the blood-stream to enter the cells where it can be used
- With diabetes, **this process is disrupted**
- A person who has diabetes does not have the key to allow sugar to move from the blood into the cells

DID YOU KNOW? Diabetes is a serious disease for which there is presently no cure; however, most diabetics can lead normal lives by controlling their blood sugar through a program including medication, diet and exercise

2 Types of Diabetes Mellitus

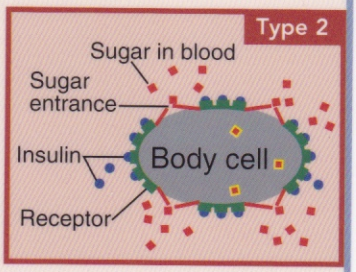
Type 1 Diabetes Mellitus

- Also referred to as **insulin-dependent diabetes mellitus (IDDM)** or **juvenile diabetes**
- The body makes *little* or *no* **insulin**
- People with ***type 1*** diabetes must take insulin shots to live
- **Less than 10%** of people with diabetes have ***type 1***
- Because of the **lack of insulin**, the *sugar* in the *blood* ***cannot*** pass into the body's cells to be used as **fuel**; instead, the blood sugar rises to a high level and overflows through the kidneys into the urine; when sugar enters the urine, water must go out with the sugar



2 Types of Diabetes Mellitus *(continued)*:

- ***Type 2* Diabetes Mellitus**
  - Also referred to as **non-insulin dependent diabetes mellitus (NIDDM)** or **adult-onset diabetes**
  - Insulin is still made in normal or increased amounts, *but it doesn't help the body use sugar very well*



  - Accounts for **90 - 95%** of all diabetes cases
  - Diet and weight loss may be the only treatment necessary in ***type 2* diabetes**
  - May be treated with a *medication*, which is not insulin, but *helps the person's cells to be more sensitive to insulin*
  - **More likely to occur in people who**:
    - Are **over 40** years of age
    - Are **overweight**
    - Have a **family history** of diabetes
    - Have had **diabetes** during a **pregnancy**
    - Have had a **baby weighing over 9 pounds**
    - Have the stress of an **illness** or **injury**
    - Have **high blood pressure**
    - Are **African-American**

The Diagnosis

- The diagnosis of children with ***type 1* diabetes** is relatively easy
- The following symptoms could indicate the presence of ***type 1* diabetes** and warrant testing, as indicated below:
  - Frequent urination
  - Frequent eating and drinking
  - Weight loss despite food intake
  - Changes in behavior
  - Fatigue
- The diagnosis of ***type 2* diabetes** is more difficult, because these symptoms tend to build up over a long period of time; they may include:
  - Feeling tired
  - Frequent infections; slow-healing cuts, sores
  - Blurred eyesight from time to time
  - Problems with sexual function
  - Dry, itchy skin; numbness or tingling of hands or feet
  - Increased thirst and frequent passing of urine
- Diagnosis of ***type 2* diabetes** is often related to identification and screening of those individuals at risk; the ADA has developed the screening questionnaire to the right to determine the risk for development of ***type 2* diabetes**

Diagnostic Testing

The following are tests that the doctor may recommend

- Blood sugar test, also known as **blood glucose level** test:
  - In ***type 1* diabetes**, the blood glucose level is usually quite high
  - In ***type 2* diabetes**, the blood glucose levels are not always higher than normal even after eating
- Sometimes, a test called a ***glucose tolerance test*** is used to identify ***type 2 diabetes***; for this test, the person drinks a large amount of a sugar drink and then blood is drawn to determine the blood glucose level at $^1/_2$-, 1- and 2-hour intervals
- **Hemoglobin A_{1C} (HbA_{1C})**
  - This test is the most valuable way to monitor blood sugar levels over time
  - **Hemoglobin** is the *protein* in the *red blood cells* that carries *oxygen* to the various parts of the body
  - If blood *sugar* is *high*, sugar *attaches* to the hemoglobin and remains there for the life of the red blood cell (an average of 2 – 3 months)
  - The results of this blood test reflect how often the blood sugars have been high for every second of the past three months
- **Fructosamine** (or **Glycosylated Albumin**) **Test**:
  - This test measures the amount of sugar attached to the main serum protein, **albumin**
  - The results of this blood test reflect the blood sugars every second of the day for the past 2–3 weeks
  - This test is helpful for someone who is changing treatment

Did You Know?

Diabetes is the 4th leading cause of death by disease in the U.S.

FYI: For diabetes info online,

www.diabetes.org
www.diabetesnet.com
www.childrenwithdiabetes.com

Blood Sugar Testing

- It is important for the diabetic to test his/her own *blood sugar*; this is an *essential* tool for good control of diabetes
- The blood sugar level can be detected by checking the sugar content of a small drop of blood
- A blood sugar reading can be done by using a test strip and comparing it to the colors on the container, or more accurate readings may be obtained by using a **blood glucose meter**
- The steps to blood sugar testing:
  - Wash hands
  - Prick the end of a finger with a small lancing device; prick the finger on the side, not the fingertip
  - Wipe away the first drop of blood
  - Apply a drop of blood to the pad on the test strip
  - *Follow the directions that come with the glucose meter to obtain the blood sugar level*

- The blood sugar may be checked before breakfast, lunch, supper and at bedtime; **talk with the doctor about exactly when and how often the blood sugar level should be obtained**
- In the event of sickness, test more often than usual
- Bring a record of all blood glucose readings and medications to every doctor's appointment

⚠ **Anytime you don't feel well, call your doctor <u>IMMEDIATELY</u>**

At-Risk Weight Chart

This chart shows weights 20% heavier than what is recommended for men and women with a medium frame; *risk* for *diabetes* is *greatly increased* when **weight** is **at or above amounts listed**

Height feet/inches without shoes	Weight pounds without clothing	
	Women	Men
4' 9"	134	---
4' 10"	137	---
4' 11"	140	---
5' 0"	143	---
5' 1"	146	157
5' 2"	150	160
5' 3"	154	162
5' 4"	157	165
5' 5"	161	168
5' 6"	164	172
5' 7"	168	175
5' 8"	172	179
5' 9"	175	182
5' 10"	178	186
5' 11"	182	190
6' 0"	---	194
6' 1"	---	199
6' 2"	---	203
6' 3"	---	209

Could you have Diabetes and not know it?

Take the Test—Know the Score (from the American Diabetes Association)

To find out if you are at risk, write the corresponding points next to each statement that is *true* for you; if a statement is *not true*, put a zero; add your total score

- My weight is equal to or above that listed in the at-risk chart
  Yes 5____
- I am under 65 years of age and get little or no exercise during a typical day
  Yes 5____
- I am between 45 and 64 years of age
  Yes 5____
- I am 65 years or older
  Yes 9____
- I am a woman who has had a baby weighing more than nine pounds at birth
  Yes 1____
- I have a sister or brother with diabetes
  Yes 1____
- I have a parent with diabetes
  Yes 1____

Total _____

Scoring 3–9 points

You are probably at low risk for having diabetes now, but don't just forget about it—you *may be at higher risk in the future*; maintaining a healthy weight and regular exercise can help you reduce your risk

Scoring 10 or more points

You are at *high risk for diabetes*; only a doctor can determine if you have diabetes; **see a doctor and find out for sure**

Insulin Resistance

- Thought to be a precursor to outright ***type 2* diabetes mellitus** because it often precedes development of diabetes by years—or even decades
- Also called **hyperinsulinemia** or **Syndrome X**
- Defined:
  - A *multi-system failure* in which tissues such as adipose (fat) and skeletal muscle exhibit *reduced sensitivity* to the actions of *insulin*
  - Degree of insulin resistance varies from individual to individual
  - Major risk factor for the development of heart disease
  - If left *untreated*, can *progress* to ***type 2* diabetes mellitus**
- An estimated **25%** of American adults have insulin resistance
- Clinical features of insulin resistance:
  - Central obesity—a person is overweight and tends to carry this excess fat around his/her waist
  - Low levels of good cholesterol (HDL)
  - High blood pressure is often associated with insulin resistance
  - Altered blood clotting mechanism resulting in formation of clots within the circulation
  - Elevated uric acid levels
- American Diabetes Association treatment goals for insulin resistance:
  - **Control blood pressure**; to begin with, the goal would be to get it below 130/85 mm Hg
  - **Improve cholesterol levels:**
    - Total cholesterol < 200 mg/dL
    - LDL (bad) cholesterol < 100 mg/dL
    - HDL (good) cholesterol > 45 mg/dL
    - Triglycerides < 200 mg/dL
  - **Manage abnormal clotting** mechanism by taking one 81 mg enteric-coated aspirin per day
- The cornerstones of treatment for insulin resistance:
  - Dietary strategies:
    - **Cut back** on the amount or serving size of **carbohydrates,** such as potatoes, bread and rice
    - **Lower total fat** and **cholesterol** in diet
  - **Weight loss**: Encourage slow weight loss of 2 to 4 pounds per month (insulin resistance can be decreased or even reversed with a 3 to 5% loss of body weight)
  - **Exercise** will sensitize insulin-resistant tissues, so 20 minutes of hard physical work 3 to 5 times per week is recommended
  - **Lower cholesterol** with diet alone or with diet plus a cholesterol-lowering medication

Goals of Treatment

- **Primary goal** of treatment for diabetes is to *restore body's ability to properly use carbohydrates*, which in turn results in normal fat and protein usage
- This goal is reached by *keeping blood sugar as close to normal as possible*

Blood-sugar control for people with diabetes (from ADA)

TEST	Level for people without diabetes	Goal for those with diabetes	Take action if:
Blood sugar before meals	Less than 110 mg/dl	70–110 mg/dl	Less than 80 or more than 140 mg/dl
Blood sugar at bedtime	Less than 120 mg/dl	100–140 mg/dl	Less than 100 or more than 160 mg/dl
HbA_{1C}	Less than 6%	Less than 7%	More than 8%

CHAOS

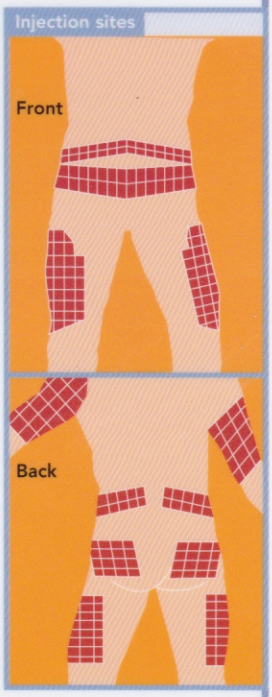
Insulin-resistance complications present as a cluster known as CHAOS:

C - Coronary artery disease (heart disease)
H - Hypertension (high blood pressure)
A - Atherosclerosis (hardening of the arteries)
O - Obesity
S - Stroke

Take Control!
It's up to you to manage your diabetes, but when you don't feel well, call your doctor IMMEDIATELY

Medications

- Most people with diabetes take either insulin or oral diabetes pills; a few people take both
- People with ***type 1*** **diabetes** *cannot* make their own **insulin**, so they *must* take insulin shots every day
- People with ***type 2*** **diabetes** produce some **insulin**, but *cannot* use it to keep their blood sugar close to normal; medications can help them maintain a normal blood sugar; however, about 40% of the people with ***type 2*** **diabetes** take insulin shots along with medication to achieve better blood sugar control
- Buying and using insulin:
  - To buy the right kind of insulin, it is necessary to know the:
    - **Species** (human, beef, pork, or analog)
    - **Brand name**
    - **Type** (NPH, Regular, etc.)
    - **Concentration** (U-100 is most common in the U.S.)
  - ⚠ ***Do not*** **change the species, brand, type, and concentration of insulin(s),** unless directed **to do so by your doctor**
  - Starting or changing insulin therapy should be done cautiously and only under medical supervision
  - Check the expiration date on the box before purchasing insulin and ***do not*** **use insulin past its expiration date**
  - The syringes *must match* the concentration of insulin
  - Keep extra bottles of insulin in the refrigerator
  - **NEVER let insulin FREEZE**
  - Keep the bottle(s) of insulin currently in use in the refrigerator whenever possible
  - If insulin cannot be kept in the refrigerator, *keep it as cool as possible* and away from heat or light
  - Do not vigorously shake insulin
  - When traveling, keep insulin in an insulated carry-on bag
  - Choose the exact site on the body where shots will be given each day
  - To keep skin, fat and muscle healthy, use a different site for each shot
  - Use all sites in one area before changing to another area
  - Follow the insulin routine exactly
  - *Balance* meals and exercise with **insulin** *intake*
  - Keep daily records of insulin shots



- Diabetes pills *are not the same* as insulin
- Diabetes pills can lower or stabilize the blood sugar level by:
  - Causing the pancreas to make extra insulin
  - Helping the body to *better use* the **insulin** it already has
  - Stopping the liver from producing *extra sugar*
  - Limiting the amount of sugar that can be absorbed by the intestines
- If diabetes pills cannot keep blood sugar within the normal range, insulin may be added

Complications

The Diabetes Control and Complications Trial (DCCT) completed in 1993 has proven that the **eye, kidney** and **nerve problems** of *diabetes* were ***much less common*** in people ages 13 – 39 years whose *blood sugars* were kept **closer to normal**

Eye Problems
- Every diabetic should have a thorough eye exam each year
- **Do not smoke** - *this accelerates eye damage*
- Visit an **ophthalmologist**, a medical doctor who specializes in eye care, ***immediately*** if there are any of these symptoms of eye damage:
  - Blurred or double vision
  - Narrowed field of vision
  - Seeing dark spots
  - Feeling of pressure or pain in the eyes
  - Difficulty seeing in dim light

Kidney Disease

Early kidney damage has no symptoms; however, a **blood test** is now available to *detect* diabetic *kidney damage* at an early stage ***when it is still reversible***; this is called the ***microalbumin test***

Neuropathy (damage to nerves)
- The symptoms of neuropathy include:
  - Numbness
  - Tingling
  - Sharp pains in the lower legs or feet

Foot Problems

Always wear *properly fitted shoes* and *examine the feet* every day for sores and signs of infection

Thyroid Disorders

Every visit to the doctor should include an examination of the size of the *thyroid* gland

Heart Attack & Stroke
- Include exercise that is aerobic in nature (one that increases your heart rate) at least 25 minutes 3 times per week
- Ask your physician to closely monitor your *cholesterol* and *triglyceride* blood levels

Frequent Infections
- Learn to spot the *first signs of infection* and what to do about them (see your doctor for any sore or cut that *doesn't* start to *heal in 24 hours*)
- Bathe every day with mild soap and lukewarm water; lotion may be applied to keep skin moist
- Wear gloves when working outside
- Always wear shoes
- **Treat injuries promptly** by cleansing with soap and water

Dental Problems
- Brush and floss every day
- See your dentist for a thorough cleaning and checkup every 6 months

Diabetes & School-Age Children

- It is essential that the family of a diabetic person informs and educates the teachers, school nurse, bus driver, gym teacher, lunchroom workers, and others involved with the child at school
- Keep an adequate, readily available supply of instant sugar at school

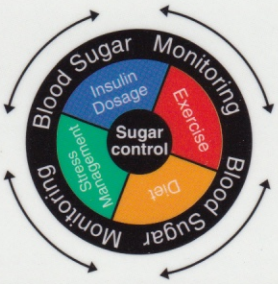
Tools you need
to take charge of Diabetes

- Education is the most basic tool of diabetes care
- Nutrition or meal planning is considered the cornerstone of diabetes management
  - The ideal diet for someone with diabetes is really just **a healthy diet**
  - Today, there is no one "diabetic" or "A.D.A." diet; individualized nutritional therapy should be based upon eating habits and lifestyle considerations; **check with your doctor to develop the best nutritional plan for you**
  - Major goals of nutritional management:
    - To help maintain *normal blood glucose* level
    - To provide a *nutritionally sound* meal plan
    - To provide a daily number of calories to attain/maintain a *desirable weight*
    - To attain/maintain *healthy levels of blood fat* (lipids); the two lipids most commonly tested for are cholesterol and triglycerides
    - To help *avoid* long-term *complications* of diabetes
- The principles of food management:
  - Eat a *well-balanced diet*, rich in carbohydrates (fruits, vegetables, whole grains), a moderate amount of protein (milk, cheese, yogurt, meat, poultry, fish, egg white, nuts), and a small amount of fat (butter, egg yolk, animal fat, etc.)
  - Keep the day-to-day intake consistent so that the medication regime matches food intake
  - Eat meals and snacks at the same time each day to prevent high/low blood sugar levels
  - Use snacks to prevent severe **hypoglycemia** by supplying the body with a constant energy source; have a bedtime snack containing protein, fat and starch to provide the body with an *energy source that will last all night*
  - **Manage carbohydrate intake carefully**, since the amount of carbohydrate eaten, the time it was eaten and what it was eaten with determine the blood sugar level
  - **Avoid over-treating low blood sugar** by eating enough carbohydrates to raise blood sugar; checking blood sugar every 10 minutes will help determine how much to eat
  - Reduce cholesterol and saturated fat intake; reduce total fat and trans-fatty acid intake
  - **Maintain appropriate weight**; avoid becoming overweight
  - Increase fiber intake
  - Avoid foods high in salt
  - Avoid excessive protein intake by eating less red meat

Meal Plan Approach

- *Best* plan is one that *fits* ***your lifestyle***
- 3 meal plans for diabetics (all 3 are effective)
  - **Constant Carbohydrate Meal Plan:** Amount of carbohydrate is kept about the same for each meal and each snack from one day to the next
  - **Carbohydrate-Counting Meal Plan:** Similar-sized "exchanges" of carbohydrates are used, but protein and fat exchanges are not used
  - **An Exchange Meal Plan:** Foods are grouped into 1 of 6 food lists, with foods in each of the 6 lists having similar numbers of calories; foods within a group can be traded for one another; consistency is key to food management and diabetes

Key components for keeping blood sugar in normal range:



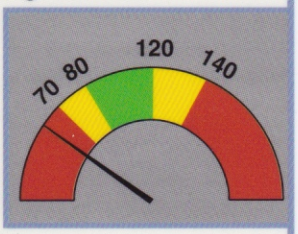
Check with your doctor before selecting any meal plan

Exercise & Diabetes

- **Exercise can help the diabetic:**
  - Burn excess sugar
  - Feel better and be proud of good physical condition
  - Keep the body in good shape
  - Keep the heart rate (pulse) and blood pressure lower
  - Keep blood fat levels normal
  - Become more sensitive to insulin—to the point that many ***type 2*** diabetics who manage their meal plan and exercise every day may be able to stop their diabetic medications (under doctor's supervision)
  - Help maintain normal blood circulation in the feet later in life
- **Before starting any exercise program, consult with your doctor or health-care provider**
- **DO NOT exercise** if **ketones** are present in the urine
- Choose types of exercise that are enjoyable, so that they are more likely to become a part of the daily routine
- Think ahead and make changes in insulin dose and snacks to help prevent low blood sugar
  - Check blood sugars before, during, and after exercise
  - Eat before heavy exercise
  - Have extra snacks available during exercise
  - For short-term activities, a more rapidly absorbed carbohydrate, such as milk or juice, is best
  - For longer-lasting activities, the snack should include protein and fat along with a carbohydrate, such as peanut butter and crackers, so that the blood sugar will remain higher for a longer time
- **Drink 8 ounces of fluid for every 30 minutes of vigorous activity**
- Avoid delayed hypoglycemia (low blood sugar several hours after exercise) by eating an extra carbohydrate at the next meal or snack, or by eating a longer-lasting snack at bedtime, or by reducing the insulin dose according to your doctor's recommendations

Safety & Diabetes

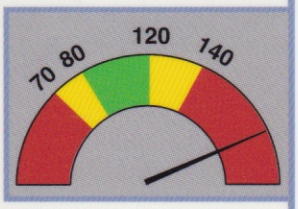
- **Diabetes identification**: Some form of diabetes identification should be with you **at all times**; this will help medical professionals administer effective and even life-saving treatment
- **Hypoglycemia**: *If blood sugar is lower than 70 mg/dl,* something with sugar *must be eaten immediately*



  - Causes:
    - Overdosing diabetes medication
    - Skipping or mistiming meals
    - Overexertion
  - Symptoms:
    - Shakiness
    - Sweating
    - Exhaustion
    - Crabbiness or confusion
    - Rapid heartbeat
    - Blurred vision
    - Headaches
  - To raise blood sugar quickly, **choose one**:
    - 3 glucose tablets
    - A cup of juice
    - A cup of regular (not diet) soda
    - 6 or 7 small hard candies (not sugar-free)
    - A cup of skim milk

To prevent overcorrection, test blood sugar every 10 minutes

- **Hyperglycemia**: *When blood sugar rises above 140 mg/dl*; may happen gradually or very suddenly



  - Causes:
    - Insufficient insulin or diabetes medication
    - Illness or stress
    - Overeating
    - Decrease in activity
  - Symptoms:
    - Excessive hunger or thirst
    - Frequency of urination
    - Dry, itchy skin
    - Sleepiness
    - Blurred vision
    - Infection
  - Treatment:
    - Strict adherence to meal plan
    - Proper diabetes medication
    - Frequent checking of blood sugar
    - Regular exercise

Develop a comprehensive plan of action for the potential emergencies that can occur with diabetes

When Sickness Strikes

- Always check **urine ketones** with any illness
- Do blood sugar tests more **frequently**
- **Never skip** an entire dose of insulin call the doctor about how to adjust the insulin dose or diabetes pills
- **Call the doctor when:**
  - There have been more than three episodes of vomiting and food or liquids will not stay down
  - There are moderate or large amounts, of ketones present
  - There is difficulty breathing
  - The person with diabetes is displaying unusual behavior, such as confusion or inability to speak

Sick-Day Foods

LIQUIDS
fruit juices
sugar-containing drinks
broth-type soups
sports drinks
tea with honey or sugar
pedialyte® or infalyte®
gelatin
popsicles®

SOLIDS
saltine crackers
bananas
applesauce
bread or toast
graham crackers
animal crackers
soup
crackers

Diabetes Research: Hope for the future

- **Non-invasive glucose monitoring – 2 minimally invasive options:**
  - GlucoWatch® is a watch that has a pad on the back of it, which draws extra-cellular fluid from under the skin; glucose level is determined three times per hour; the glucose levels can be read on the watch and an alarm for high glucose or low glucose levels can be set
  - The FDA has approved the **Continuous Glucose Monitoring System** (CGMS)® by MiniMed, Inc.; the monitor reads glucose levels every five minutes; a plastic catheter that can stay in place up to 3 days is inserted
- **A cure?**
  - Surgeons can now cure ***type 1*** **diabetes** by doing a whole (or partial) **pancreas transplant**
  - Unfortunately, the medications to prevent rejection of the transplanted pancreas have some serious side effects
  - Research on transplanting animal islet cells or cloning islet cells that produce insulin are ongoing, but moving slowly

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