Stay Fit for the Future! Or “Out with Gout”

Learning Objectives

Through this lesson, students will

- Learn about diseases that can result from long-term physical inactivity.
- Explore the benefits of being physically active.
- Identify different kinds of exercise and design an exercise plan that fits their individual needs and interests.
- Cultivate good health practices to remain active today and in the future.

Time Required for Lesson: 45-60 minutes

Class Preparation: None

Supplies needed:

- Whiteboard or chalkboard and markers or chalk
- Timer or stopwatch
- Various weights (or a some moderately heavy objects to serve as weights)
- Computers or tablets opened to the Memento Mütter pages for Hands with Gout (http://memento.muttermuseum.org/detail/hands-with-gout) and the Transmetatarsal Amputations (http://memento.muttermuseum.org/detail/transmetatarsal-amputations). If the resources are available, have enough devices open to these pages for students to explore them individually or in groups. If resources are limited, have one device open for the class to examine together.

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Academic Standards:


Key Terms
**Aerobic Exercise:** Also known as endurance exercise or cardiovascular exercise, activities designed to strengthen the heart and lungs by increasing heart rate and respiration.

**Anaerobic Exercise:** Also known as strength exercises, high-intensity activities conducted in short intervals to develop muscle strength.

**Gout:** A form of arthritis caused by an excess buildup of uric acid in the blood. Characterized by painful, disfiguring crystal deposits along the joints called tophi.

**Heart Disease (Cardiovascular Disease):** A narrowing or hardening of the arteries due to an excess buildup of plaque. The leading cause of death in the United States.

**Hemorrhagic Stroke:** Condition where a blood vessel in the brain bursts, causing brain cells to die.

**Ischemic Stroke:** Condition where a blood vessel in the brain is clogged, causing brain cells to die.

**Obesity:** A state in which a person’s weight exceeds the level of what is considered healthy based on their height.

**Repetition ("Rep"):** A repetitive action performed as part of a set.

**Set:** A sequence of repetitive actions.

**Type-2 Diabetes:** A condition where the pancreas cannot properly process sugar, causing an excess buildup of glucose.

**Overview:**

**Part 1 (Lesson Opening): Introduction to Diseases Caused (in Part) by Physical Inactivity**

Remaining physically active (along with other lifestyle choices) is a key part of promoting good health and reducing the risk of long-term health problems. It is important for young people to develop healthy habits early in life as decisions adolescents make will carry over to their adult lives.

*To begin this lesson, have students examine and assess several long-term health complications that can occur due to physical inactivity and unhealthy diets.*

Individually or in small groups have students examine the **Hands with Gout** and the **Transmetatarsal Amputations.** Encourage students to make use of the site’s interactive functions (zoom, rotation) and read the annotations and additional materials. If there are not enough devices, this can also be directed by the instructor on one projected screen. Ask them to share something they find striking about the images and information.

**What are the students looking at?**

**Hands with Gout**

Gout is a form of arthritis caused by an excess buildup of uric acid in the blood (hyperuricemia). The uric acid crystalizes into deposits known as tophi which form along the patient’s joints. The tophi cause disfiguring lumps, swelling, redness, stiffness, and great pain. The pain flares up and
can last for days at a time. Uric acid buildup in the kidneys can cause kidney stones. Patients typically first experience symptoms in their big toe; however, gout can also affect other joints in the body, such as the ankles, wrists, fingers, and knees.

Hyperuricemia is caused by excessive eating of foods high in purines, such as liver, beans, prunes, and anchovies. Drinking alcohol in excess over a long period of time can also lead to gout. Gout can also be brought upon by joint injuries, surgery, and infections. It is also a possible side effect of certain medications or chemotherapy treatment. High levels of lead consumption can also lead to gout.

Through the nineteenth century, gout was common among wealthy people as they had greater access to rich diets and more physical inactivity. This led to gout’s historical nickname as “the disease of kings.” Statistical data on gout’s prevalence in the US is outdated; as of 2008, 8.3 million Americans suffered from gout.

Historically physicians treated gout by attempting to reduce the swelling through bloodletting and regular bandaging and elevation of the affected joints. Today, gout is treated through medication, a healthy diet, and regular exercise.¹

**Transmetatarsal Amputation: Type 2 Diabetes**

A physician amputated these specimens from a living patient, a 45-year-old man, who suffered from Type 2 diabetes.

Type 2 diabetes is a condition in which the body cannot properly manage its blood sugar levels. Typically, blood sugar levels are maintained by the pancreas by generating a hormone called insulin. However, in a patient with Type 2 diabetes the pancreas cannot produce the necessary amount of insulin to process sugars. This results in an excess buildup of glucose (hyperglycemia). Symptoms of Type 2 diabetes include fatigue, frequent urination, blurred vision, and tingling, pain or numbness in the extremities. Over time, diabetes can cause severe health complications, including nerve damage (diabetic neuropathy), heart and kidney disease, blindness (diabetic retinopathy), and strokes. Nerve damage can be severe enough to warrant amputation.

Type 2 diabetes can be a genetic condition, inherited from birth, or can be the result of poor diet and a lack of exercise. Obesity is also a leading cause of diabetes. According to a 2012 report by the American Diabetes Association, 29.1 million Americans suffer from diabetes and roughly 86 million Americans above the age of twenty are at risk of developing Type 2 diabetes (prediabetes). Studies have shown that certain demographic groups, including African Americans and Native Americans, are at greater risk for diabetes.

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In addition to medication, exercise and a carefully-monitored diet, diabetic patients need to monitor their blood glucose levels daily.²

Other examples of long-term health problems that can develop due to inactivity include:

- **Obesity:** Weight that is over the levels of what is viewed as healthy for a person relative to their height. According to the Centers for Disease Control and Prevention (CDC), obesity affects roughly 17% of children (defined as aged 2-19) in the United States. That translates to approximately 12.7 million children. The CDC also reports 36.5% of American adults are classified as obese.³
- **Heart disease (cardiovascular disease):** A narrowing or hardening of the arteries due to an excess buildup of plaque; this buildup can lead to a heart attack or stroke. Heart disease is the most common cause of death among Americans, accounting for one out of every four deaths in the United States per year.⁴
- **Stroke:** There are two types of strokes: ischemic stroke (most common) in which a blood vessel in the brain is clogged and hemorrhagic stroke where a blood vessel in the brain bursts. Either can cause brain cells to die, resulting in motor or neurological impairments or death. Strokes are responsible for one out of every twenty deaths in the United States per year.⁵
- **Certain kinds of cancer have also been linked to inactivity.**

*Explain that by the end of this lesson the students will learn about different kinds of exercise and be able to draft their own personalized exercise plans.*

**Part 2: Overview of Aerobic and Anaerobic Exercise**

**Exercise Overview**

In order to reduce the risk of certain health complications, it is important to remain physically active through regular exercise.

**Benefits of Regular Exercise:**

In addition to lowering the risk of certain diseases, other benefits of regular exercise include:

- Increased energy
- Increasing lung capacity
- Strengthening the heart’s ability to circulate blood
- Strengthening muscles
- Strengthening bones and joints


Lowering blood pressure and cholesterol levels
Decreasing body fat
Improving mood and reducing anxiety and stress

Two Types of Exercise: Endurance and Strength

Endurance Exercise

Definition: Also known as aerobic exercise or cardiovascular exercise (“cardio”), the American Academy of Orthopaedic Surgeons defines this kind of exercise as “any activity that gets you moving and increases your heart rate.”6 Aerobic exercise focuses on building endurance by strengthening the heart and lungs through rhythmic activities done over an extended period of time. Degrees of aerobic exercise are categorized by level of intensity: easy, moderate, and vigorous.

According to the CDC, a way to distinguish between moderate and vigorous intensity exercises is through what is known as a “talk test.” If a person is able to talk, but not sing, during the exercise, it is considered a moderate activity. During a vigorous exercise, it will be difficult to say more than a few words between breaths.7

The American Heart Association recommends children age two and older take part in at least one hour of moderate-intensity aerobic activities a day. This routine can be divided into two 30-minute installments or even four 15-minute sessions.8

For adults, the AHA recommends a weekly regimen of 150 minutes per week of moderate exercise or 75 minutes per week of vigorous exercise or a combination of moderate to vigorous exercise to promote cardiovascular health. This translates to 30 minutes a day, five days a week for moderate intensity exercise or 25 minutes a day, three days a week for vigorous activity. These times can also be divided into smaller installments (i.e. three 10-minute sessions per day)9

Guided Practice:

Endurance exercise demonstration:

Each student stands up (make sure there is adequate space between students).

Have each student take their own pulse. The pulse can be found by having each student place two fingers to the inside of their wrist just below the thumb. One can also place two fingers along the side of the neck. Instruct students to not use their thumb as it has its own pulse.

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The instructor sets a time for thirty seconds, during which time each student counts the number of beats they feel. After the time has have expired, each student takes that number and doubles it. The resulting number is the student’s resting heart rate, measured in beats per minute.

Set a timer for two minutes and have each student jog in place (again, make sure there is adequate space between students to minimize the risk of injury).

After the two minutes expire, have each student measure their pulse again. Have students share their results with the class. (Aerobic exercises are designed to increase your breathing and heart rate, so they should experience an increase in their pulse.)

**Teacher Action:** Ask the students to think about what kinds of activities could qualify as aerobic exercise. List them on the board.

**Examples Include:**
- Walking
- Running/Jogging
- Cycling
- Dancing
- Swimming
- Skiing
- Mowing the lawn

*Encourage them to also think of activities that are part of their regular routine that can also be considered exercise, such as walking or biking to school.*

**Strength Exercise:**

**Definition:** Also known as anaerobic exercise or muscle-strengthening exercise these kinds of exercises focus on developing muscle strength through high intensity activities in short intervals. Strength exercises typically involve performing a sequence of repetitive actions known as a set. A single act in a set is called a repetition (or “rep”). A rest period takes place between sets.

**Guided Practice: Strength Exercise Demonstration**

Each student stands up (make sure there is adequate space between students). Have the students experiment by holding different amounts of weight and lifting them, rhythmically performing a set of as many reps as they feel comfortable. This can be achieved with actual exercise weights, but a moderately heavy textbook can also suffice. (It is a good practice to decrease the number of reps as the amount of weight increases.)

**Teacher Action:** Ask the students to think about what kinds of activities could qualify as anaerobic exercise. List them on the board.

**Examples Include:**
- Sprinting
- Gymnastics
- Lifting weights
Yoga
• Sit-ups
• Push-ups

The CDC recommends children take part in strength exercise at least three days a week. Adults should take part in muscle-strengthening activities on two or more days a week. Because of the higher-intensity workout than aerobic exercise, allow 1-2 days between workout sessions to allow your body to rest and recover.10

**Guided Practice:**

*Ask the students to state differences between strength and endurance exercises and list them on the board.*

**Part 3: (More New Material) General tips for starting and maintaining an exercise routine:**

- Consult a doctor before you begin any kind of rigorous exercise regimen.
- An effective exercise routine provides a balance of aerobic and anaerobic activities.
  - Team sports, such as basketball, football, soccer, hockey, and lacrosse, offer a balance of intensities and duration.
- Start simple and work your way up gradually; don’t overdo it at the outset as you may risk injury. Progression will also help you build up a routine that you will want to do.
  - A useful way to monitor your progress is by keeping an exercise journal. Each time you exercise, document the kinds of activities and duration. Make note of the number of reps and sets for strength activities, distance and time for endurance activities.
- Be creative. Think of how you can adapt your regular activities into exercise.
- Get a friend to exercise with you. You are more likely to stick to an exercise routine if you have someone with you. If you prefer working alone, listen to music as you go.
- Always remember to stay hydrated. Drink plenty of water before, during, and after your regimen. Avoid drinks that contain sugar.
- Combine your exercise routine with other healthy lifestyle choices:
  - Maintain a healthy diet, focusing on fruits, vegetables, whole grains, low fat-dairy products, skinless poultry or fish, nuts and legumes, and non-tropical vegetable oils. Limit or avoid intake of foods containing saturated fat, trans. fat (trans-unsaturated fatty acids), and sodium.11
  - Get plenty of rest. The National Sleep Foundation recommends 9-11 hours of sleep for children (6-13), 8-10 hours for teenagers (14-17), and 7-9 hours for adults (18-64).12

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Avoid smoking, alcohol, and drugs
• Remember to breathe.

Part 4: Independent Practice:

Now that the students have a general understanding of different kinds of exercise, have students work independently to devise a personalized exercise plan with at least one endurance and one strength activity. Devise a method of implementing that plan. After sufficient time has passed, have students share and discuss their exercise plans as a group.

Part 5: Debrief and Lesson Closing:

Ask the students to share one thing they learned that they did not before the lesson.

Have them explain one health benefit of regular exercise.

Part 6: (Optional) Post-Lesson Activity:

Encourage each student to attempt to carry out their exercise plan (for a week, two weeks, or a month) and have them track their progress by keeping an exercise journal (a useful template can be found here: http://jamesclear.com/workout-journal) or using an app on their phones. Have them check back with their results in a later class.