Cardiovascular Diseases and Diabetes
LEARNING OBJECTIVES

- Identify the components of the cardiovascular system and the various types of cardiovascular disease
- Discuss ways of promoting cardiovascular health through an examination of the major controllable health factors
- Understand the differences between Type-1 and Type-2 diabetes
- *Explore chronic lung diseases through an examination of the respiratory system*
Cardiovascular Diseases

- **Cardiovascular disease (CVD):** any disease involving the heart and/or blood vessels
- Currently the leading cause of death in the United States, accounting for one-third of all deaths
CVD is a general term for diseases that include heart attack, stroke, peripheral artery disease, congestive heart failure, and others.
Atherosclerosis

Involves a thickening or hardening of the arteries due to the buildup of fats and other substances. The disease process underlying many forms of CVD.
Atherosclerosis

1) Damage to the inner lining of vessels and the formation of a fatty streak
2) Accumulation of lipoproteins within the walls of an artery
3) Once an injury exists on the artery, plaque forms (accumulation of debris in an artery wall)
4) Results in slow blood flow, reducing the amount of blood to the tissues
5) Plaque can break off and completely block artery

*Atherosclerosis is the underlying cause for most heart attacks, stroke and peripheral vascular disease*
Coronary Heart Disease and Heart Attack

- **Coronary heart disease (CHD):** atherosclerosis of the coronary arteries, which can result in a heart attack.

- CHD is the leading form of all cardiovascular diseases.

- An estimated 16.3 million Americans are living with CHD.
Coronary Heart Disease and Heart Attack

**Ischemia:** insufficient supply of oxygen and nutrients to tissue, caused by narrowed or blocked arteries

**Myocardial infarction:** artery completely plugged resulting death of heart tissue

**Coronary thrombosis:** blockage of a coronary artery by a blood clot that may cause sudden death

**Angina:** pain, pressure, heaviness, or tightness in the center of the chest caused by a narrowed coronary artery (not complete blockage)
Arrhythmias and Sudden Cardiac Death

**Arrhythmia:** irregular or disorganized heartbeat

*Atrial fibrillation:* most common type of arrhythmia caused by abnormal firing of electrical impulses

*Ventricular fibrillation:* type of arrhythmia in which the ventricles contract rapidly and erratically
Most serious, heart cannot pump blood

➢ *Sudden cardiac death:* abrupt loss of heart function caused by an irregular or ineffective heartbeat
Automated External Defibrillator (AED)
Cardiopulmonary Resuscitation (CPR)

Tap and shout
Yell for help. Send someone to phone 911 and get an AED

Look for no breathing or only gasping
Push hard and fast. Give 30 compressions

Open the airway and give 2 breaths
Repeat sets of 30 compressions and 2 breaths

When the AED arrives, turn it ON and follow the prompts
Tap and shout
Yell for help. Send someone to phone 911

Look for no breathing or only gasping

Push hard and fast.
Give 30 compressions

Open the airway and give 2 breaths

Repeat sets of 30 compressions and 2 breaths

If you are alone after 5 sets of 30 compressions and 2 breaths, phone 911, and then resume sets of 30:2
Tap and shout
Yell for help. Send someone to phone 911 and get an AED

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When the AED arrives, turn it ON and follow the prompts
Stroke

A stroke or cerebrovascular accident (CVA) occurs when blood flow to the brain or part of the brain is blocked.

Fourth leading cause of death in the United States
Leading cause of severe, long-term disability

Stroke – there’s treatment if you act FAST.

Face
- Face look uneven?

Arm
- One arm hanging down?

Speech
- Slurred speech?

Time
- Call 911 NOW!

Helpline NSA/ 1-800-787-6537
Transient Ischemic Attacks (TIAs)

“Ministrokes”: periods of restricted blood supply that produce the same symptoms as a stroke

TIA is a warning sign of future stroke (about 40% of TIA patients will have a future stroke)

Symptoms of TIAs can resolve within minutes or a couple of hours

Very important to seek immediate medical attention
Types of Stroke

Hemorrhagic stroke
- Caused by ruptured blood vessels followed by blood leaking into tissue; more serious than ischemic stroke

Ischemic stroke
- Caused by blockage in brain blood vessels; potentially treatable with clot-busting drugs

Subarachnoid hemorrhage
- A bleed into the space between the brain and the skull

Embolic stroke
- Caused by emboli, blood clots that travel from elsewhere in the body to the brain blood vessels

Intracerebral hemorrhage
- A bleed from a blood vessel inside the brain

Thrombotic stroke
- Caused by thrombi, blood clots that form where an artery has been narrowed by atherosclerosis
Congestive Heart Failure

- Condition in which the heart is not pumping the blood as well as it should, allowing blood and fluids to back up in the lungs

- Can develop after a heart attack or as a result of hypertension, heart valve abnormality, or disease of the heart muscle

- Person with this condition experiences difficulty breathing, shortness of breath, coughing, fatigue, and confusion
Other Cardiovascular Diseases

Heart valve disorders

Most common is the *mitral valve prolapse*
Congenital heart disease: structural defect at birth (defective vessels, leaky valves, hole in the heart)

Peripheral vascular disease (PVD):
Atherosclerosis in the arteries of the arms and legs

Pains, aches and cramping
Cardiomyopathy: disease of the heart muscle

Enlargement of the heart

- Chambers relax and fill, then contract and pump.
- Muscle fibers have stretched. Heart chambers enlarge.

Thickening of one part of the heart
- Mostly the left ventricle
Major Controllable Factors in Cardiovascular Health

- Tobacco use
- Blood pressure levels
- Cholesterol levels
- Physical activity
- BMI
- Blood glucose levels
- Diet
Blood Pressure

Force exerted by blood against artery walls
Determined by two forces:
  Pressure when the heart contracts (systolic; top number)
  Pressure in the arteries when the heart is relaxed (diastolic; bottom number)
**Hypertension:** blood pressure that is forceful enough to damage artery walls

Untreated high blood pressure/hypertension:
- Can weaken and scar the arteries and make the heart work harder
- Can cause heart attacks, strokes, kidney disease, peripheral artery disease, and blindness

**Hypotension:** low blood pressure, especially in the arteries of the systemic circulation
<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic (mmHg)</th>
<th>Diastolic (mmHg)</th>
</tr>
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<tbody>
<tr>
<td>Normal</td>
<td>Less than 120 and</td>
<td>Less than 80</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120–139 or</td>
<td>80–89</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>140–159 or</td>
<td>90–99</td>
</tr>
<tr>
<td>Stage 2</td>
<td>160 and above or</td>
<td>100 and above</td>
</tr>
</tbody>
</table>

| **Total cholesterol (mg/dL)** | **Desirable**  
Less than 200  
200–239  
240 or greater | **Borderline high**  
High |
|-------------------------------|------------------|------------------|
| **LDL cholesterol (mg/dl)**  | **Near or above optimal**  
Less than 100*  
100–129  
130–159  
160–189  
190 or greater | **Optimal**  
Borderline high  
High  
Very high |
| **HDL cholesterol (mg/dl)**  | **Low (undesirable)**  
Less than 40  
60 or greater | **High (desirable)** |
| **Triglycerides (mg/dl)**    | **Normal**  
Less than 150  
150–199  
200–499  
500 or greater | **Borderline high**  
High  
Very high |

*Achieving a goal of less than 70 is an option if there is a high risk for heart disease.*

Noncontrollable Factors in Cardiovascular Health

- Age
- Gender
- Genetics and family history
- Ethnicity and race
- Postmenopausal status
Testing and Treatment for Heart Disease

- **Diagnostic testing**
  - Electrocardiogram (ECG or EKG)
  - Echocardiogram (sound waves)
  - Exercise stress test

- **Medical management**
  - Anti-arrhythmics
  - Anti-anginals
  - Anti-coagulants

- **Surgical management**
  - Defibrillator implant
  - Angioplasty (balloon catheter)/ Coronary stent
  - Coronary artery bypass grafting
Management of Stroke

- If thrombotic, thrombolytic medications can dissolve clot and restore blood flow to the brain

- If hemorrhagic, depends on the underlying cause of the bleed; sometimes surgery is necessary

- Rehabilitation, usually including physical therapy, an important component
Diabetes

Metabolic disorder resulting in elevated blood glucose levels due to a disruption in the production or use of insulin

Rates of diabetes have doubled every 15 years since the 1950s

**Insulin:** a protein hormone produced in the pancreas
- Allows the body to use glucose for energy or to store glucose for future use
- Regulates level of glucose in the blood to avoid hyperglycemia or hypoglycemia
**Normal**

Insulin binds to receptors on the surface of a cell and signals special transporters in the cell to transport glucose inside.

**Type 1 diabetes**

The pancreas produces little or no insulin. Thus, no signal is sent instructing the cell to transport glucose, and glucose builds up in the bloodstream.

**Type 2 diabetes**

The pancreas produces too little insulin and/or the body’s cells are resistant to it. Some insulin binds to receptors on the cell’s surface, but the signal to transport glucose is blocked. Glucose builds up in the bloodstream.
Type-1 Diabetes

- Caused by the destruction of insulin-producing cells in the pancreas by the immune system
- Insulin must be provided from an external source to keep blood glucose levels under control
- Onset usually occurs before age 20
- Probably a result of a combination of genetic, autoimmune, and environmental factors
- Physical activity is an important component of control and reduction in long-term complications
Type-2 Diabetes

- Caused by insulin resistance in the insulin receptors in body cells
- Pancreas responds by increasing production of insulin, but eventually cannot keep up
- Accounts for 90–95% of all diabetes cases
- Incidence rising in parallel with obesity levels
- Onset is usually gradual
Type-2 Diabetes Detection and Treatment

Blood test to look at fasting glucose level

_Treatment_

- Lifestyle modification
- Oral medications
- Insulin replacement
- Exercise particularly important
- Monitored by blood test called the hemoglobin A1c test
Gestational Diabetes

- Develops in 2–10% of pregnancies
  - Hormonal changes affect the body’s response to insulin
  - Higher risk for pregnancies after age 35
- In 5–10% of cases, diabetes becomes an ongoing condition
- Women with a history of gestational diabetes are at a higher risk of developing diabetes in the next 10–20 years