Chapter 14: Cardiovascular Disease, Diabetes, and Chronic Lung Diseases

Cardiovascular Disease

- **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 failure, and others
- The disease process underlying many forms of CVD is **atherosclerosis,** or hardening of the arteries

Deaths from Types of CVD in the U.S., 2013

Atherosclerosis

- A common form of arteriosclerosis that involves a thickening or hardening of the arteries due to the buildup of fats and other substances
  - Starts with damage to the inner lining of vessels and the formation of a fatty streak—accumulation of lipoproteins within the walls of an artery
  - Once an injury exists on the artery, white blood cells, collagen, and other proteins are formed, creating plaque (accumulation of debris in an artery wall)
    - Results in slow blood flow, reducing the amount of blood to the tissues
    - Plaque can break off and completely block artery

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
- Those who survive a heart attack are often left with damaged hearts and significantly altered lives

Summary:
Coronary Heart Disease and Heart Attack

- **Ischemia**: insufficient supply of oxygen and nutrients to tissue, caused by narrowed or blocked arteries
- **Myocardial infarction**: lack of blood flow to the heart muscle with resulting death of heart tissue, often called a heart attack
- **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

Arrhythmias and Sudden Cardiac Death

- **Arrhythmia**: irregular or disorganized heartbeat
- Normal adult heart rate is 60–100 beats/minute
- **Ventricular fibrillation**: type of arrhythmia in which the ventricles contract rapidly and erratically, causing the heart to quiver or “tremor” rather than beat
- **Sudden cardiac death**: abrupt loss of heart function caused by an irregular or ineffective heartbeat

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
  - **Ischemic stroke**: caused by blockage in a blood vessel in the brain (accounts for 87% of all strokes)
    - Thrombus
    - Embolism
  - **Hemorrhagic stroke**: caused by rupture of a blood vessel in the brain, with bleeding into brain tissue
- *Transient ischemic attacks (TIAs)* “ministrokes”; periods of restricted blood supply that produce the same symptoms as a stroke

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

Summary:
**Other Cardiovascular Diseases**
- Heart valve disorders
  - Most common is the mitral valve prolapse
- Congenital heart disease
  - Structural defect at birth
- Peripheral vascular disease (PVD)
  - Atherosclerosis in the arms and legs
- Cardiomyopathy
  - Disease of the heart muscle
    - Dilated
    - Hypertrophic

**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

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic (mmHg)</th>
<th>Diastolic (mmHg)</th>
</tr>
</thead>
<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>

**Summary:**
### Contributing Factors in Cardiovascular Health

- **Triglyceride levels**
  - Levels of these blood fats should be less than 150 to achieve desired levels

- **Alcohol intake**
  - **Heavy drinking** (more than 3 drinks/day) can damage the heart
  - **Light drinking** (less than 2 drinks/day) can increase HDL levels, therefore protecting against heart disease and stroke risk

- **Psychosocial factors**
  - Personality, chronic stress, socioeconomic status, depression, and social support

### Non-controllable 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**
  - Antiarrhythmics
  - Antianginals
  - Anticoagulants

- **Surgical management**
  - Angioplasty (balloon catheter)
  - Coronary artery bypass grafting

### Table 14.2 Cholesterol Guidelines

<table>
<thead>
<tr>
<th>Total cholesterol (mg/dL)</th>
<th>Desired</th>
<th>Borderline high</th>
<th>High</th>
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<tbody>
<tr>
<td>Less than 200</td>
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</tr>
<tr>
<td>200–239</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>240 or greater</td>
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<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>LDL cholesterol (mg/dL)</th>
<th>Near or above optimal</th>
<th>Optimal</th>
<th>Borderline high</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 100*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100–129</td>
<td></td>
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<td>130–159</td>
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<td>160–189</td>
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<tr>
<td>190 or greater</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>HDL cholesterol (mg/dL)</th>
<th>Low (undesirable)</th>
<th>High (desirable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 40</td>
<td></td>
<td></td>
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<tr>
<td>60 or greater</td>
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<table>
<thead>
<tr>
<th>Triglycerides (mg/dL)</th>
<th>Normal</th>
<th>Borderline high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 150</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>150–199</td>
<td>Borderline high</td>
<td></td>
</tr>
<tr>
<td>200–499</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>500 or greater</td>
<td>Very high</td>
<td></td>
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</tbody>
</table>

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

### Summary:

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Management of Stroke

- Management
  - 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

Areas of Interest for Future CVD Research

- Researchers are looking at how the following are associated with CVD:
  - Low levels of vitamin D
  - High blood levels of homocysteine, an amino acid
  - Metabolic syndrome
  - Inflammation
  - High levels of C-reactive protein in the blood
  - Infections that may cause atherosclerotic plaques to break free
  - Lower birth weight

Diabetes

- Most common disorder of the endocrine or metabolic system
- Rates of diabetes have doubled every 15 years since the 1950s
- All types of diabetes result in elevated blood glucose levels due to a disruption in the production or use of insulin

Insulin and Glucose Uptake

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

Summary:
**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
  - Visceral fat and lack of physical activity are strong indicators of risk
- Onset is usually gradual
- *Prediabetes*: fasting blood glucose levels between 100 and 126 mg/dl
  - Dietary changes, exercise, weight loss can prevent or delay onset

**Metabolic Syndrome**
- Set of conditions that significantly increases the risk for developing diabetes and other health complications
- Diagnosed if three of the following present:
  - Fasting glucose level ≥ 100
  - HDL cholesterol < 40 in men; < 50 in women
  - Triglycerides ≥ 150
  - Waist circumference ≥ 40" for men; ≥ 35" for women
  - Systolic blood pressure ≥ 130 and diastolic blood pressure ≥ 85

**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

**Summary:**
Chronic Lung Diseases
- Also known as chronic lower respiratory diseases
- Third leading cause of death in the U.S.
- Two most common forms:
  - Asthma
    - Large genetic component
  - Chronic obstructive pulmonary disease (COPD)
    - More typical in older adults
- Both are triggered by smoking, infection, and pollution

The Respiratory System

Asthma
- Chronic inflammation, obstruction, and constriction of the airways, causing wheezing, coughing, chest tightness, and shortness of breath
- Attack occurs in response to a trigger: an allergen or an irritant in the air
- Diagnostic categories:
  - Intermittent: no symptoms between episodes
  - Mild persistent: symptoms a few times a week
  - Moderate: daily symptoms limit normal activity
  - Severe: daily symptoms place extreme limits on normal activity

Asthma
- Bronchodilators: quick-relief medications used during an attack to reduce symptoms
  - Delivered through an inhaler
- For long-term control:
  - An inhaled steroid that works within the bronchioles to reduce inflammation
  - Avoidance of common triggers such as tobacco smoke, allergens, and air pollution
    - Flu shots recommended if viruses and infections are triggers

Summary:
### COPD

- Tends to develop from cumulative damage to airways and alveoli; primary cause is smoking
- Chronic bronchitis: persistent inflammation of the bronchioles; excess mucus
  - Bronchial congestion and a chronic cough
- Emphysema: alveoli become less elastic, and walls between alveoli are damaged or destroyed
  - Person is breathless and gasps for air
  - Strains the heart
  - Cannot be reversed; supplemental oxygen may be necessary at later stages

### Preventing Chronic Diseases

- Eat a heart-healthy diet
- Avoid overweight and obesity
- Don’t smoke, and avoid secondhand smoke
- Be physically active
- Limit alcohol consumption
- Maintain healthy blood pressure levels
- Maintain healthy lipid levels
- Maintain healthy blood glucose levels
- Manage stress, and take care of your mental, emotional, and social health

**Summary:**