Wolters Kluwer
When you have to be right

Introduction to Clinical Pharmacology

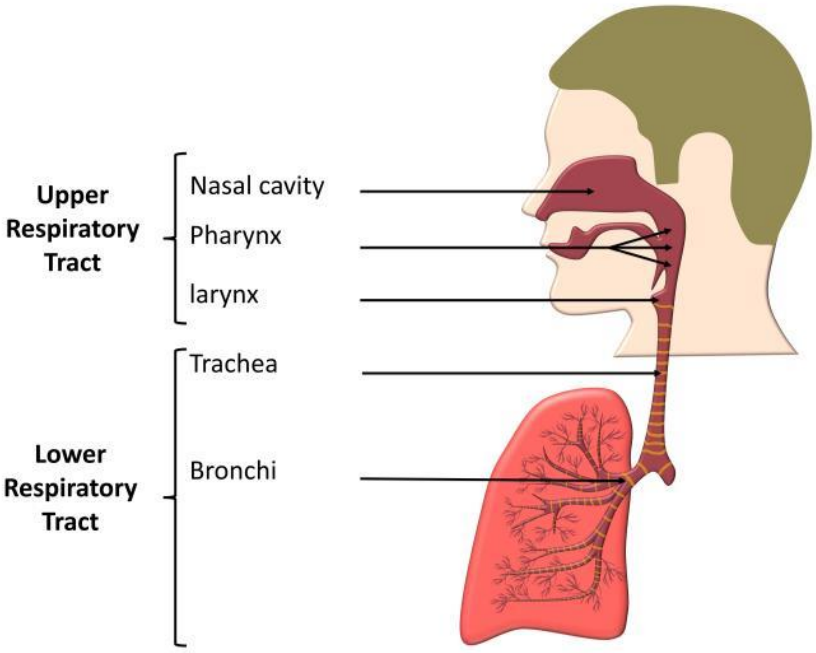
Chapter 31
Lower Respiratory System Drugs

Learning Objectives

1. Explain the uses, general drug actions, general adverse reactions, contraindications, precautions, and interactions of the bronchodilators and antiasthma drugs.
2. Distinguish important preadministration and ongoing assessment activities the nurse should perform on the client taking a bronchodilator or an antiasthma drug.
3. List nursing diagnoses particular to a client taking a bronchodilator or an antiasthma drug.
4. Examine ways to promote an optimal response to therapy, how to manage common adverse reactions, and important points to keep in mind when educating a client about the use of bronchodilators or antiasthma drugs.

Common Conditions of the Lower Respiratory System

- COPD
- Asthma
- Chronic bronchitis
- Chronic obstructive bronchitis
- Emphysema
- Lower respiratory tract infections



Asthma/Chronic Pulmonary Disorder Mediations

- Long-Term Control Medications
  - Step-wise approach
  - Inhaled corticosteroids
  - Mast cell stabilizers
  - Leukotriene formation inhibitors
  - Leukotriene receptor agonists
  - Immunomodulators
- Quick-Relief Medications
  - Inhaled short-acting beta$_2$-adrenergic (β_2-adrenergic) agonists (SABAs)
  - Oral steroids

Pharmacology in Practice Exercise #1

- A client has been prescribed a step care approach regiment for the treatment of asthma. Which of the following drugs may be given as adjuncts to bronchodilator therapy in such a case? Select all that apply.

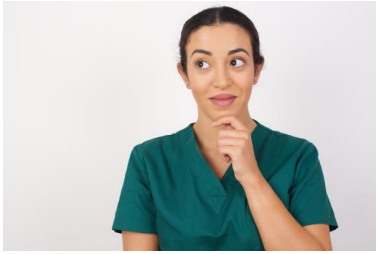
a) Decongestants

b) Inhaled corticosteroids

c) Uricosuric agents

d) Mast cell stabilizers

e) Immunomodulators

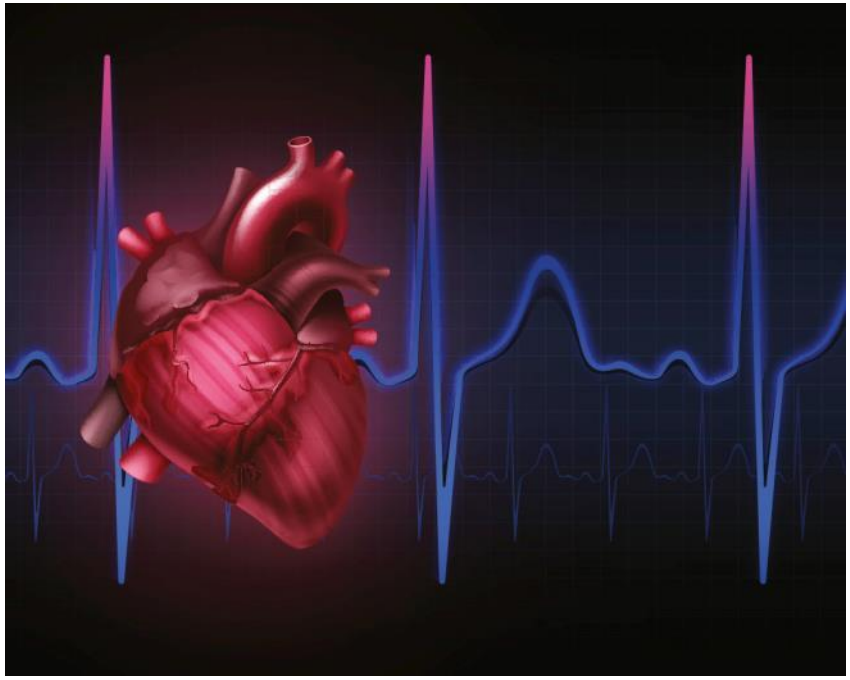


Adrenergic Bronchodilators—Actions and Uses

- **Actions**
  - Simulates beta$_2$-adrenergic receptors resulting in a relaxation of the smooth muscles and an opening of the bronchi or bronchodilation; relieves respiratory distress
- **Uses (Bronchoconstriction)**
  - Bronchospasm associated with acute and chronic bronchial asthma
  - Exercise-induced bronchospasm
  - Bronchitis
  - Emphysema
  - Bronchiectasis
  - Other obstructive pulmonary diseases

Adrenergic Bronchodilators—Adverse Reactions #1

- Cardiovascular System Reactions:
  - Tachycardia
  - Palpations
  - Cardiac arrhythmias
  - Hypertension



Adrenergic Bronchodilators—Adverse Reactions #2

- Other Reactions:
  - Nervousness
  - Anxiety
  - Insomnia

Adrenergic Bronchodilators—Contraindications

- Contraindicated in clients with:
  - known hypersensitivity to the drug
  - Cardiac arrhythmias associated with tachycardia
  - Organic brain damage
  - Cerebral arteriosclerosis
  - Narrow-angle glaucoma
  - Acute bronchospasm (salmeterol)

Adrenergic Bronchodilators—Precautions

- Use cautiously in clients with:
  - hypertension
  - cardiac dysfunction
  - hyperthyroidism
  - glaucoma
  - diabetes
  - prostatic hypertrophy
  - history of seizures
  - pregnancy (Pregnancy category B and C)
  - lactation

Inhaled Steroids—Interactions #1

Interacting Drug	Common Use	Effect of Interaction
Adrenergic drugs	Treatment of hypotension and shock	Possible additive adrenergic effects
Tricyclics	Treatment of depression	Possible hypotension
Beta-adrenergic blockers	Treatment of hypertension	Inhibition of the cardiac, bronchodilating, and vasodilating effects of the adrenergic

Inhaled Steroids—Interactions #2

Interacting Drug	Common Use	Effect of Interaction
Methyldopa	Treatment of hypertension	Possible hypotension
Oxytocic drugs	Uterine stimulant	Possible severe hypotension
Theophylline	Treatment of asthma and COPD	Increased risk for cardiotoxicity

Xanthine Derivative Bronchodilators—Actions and Uses

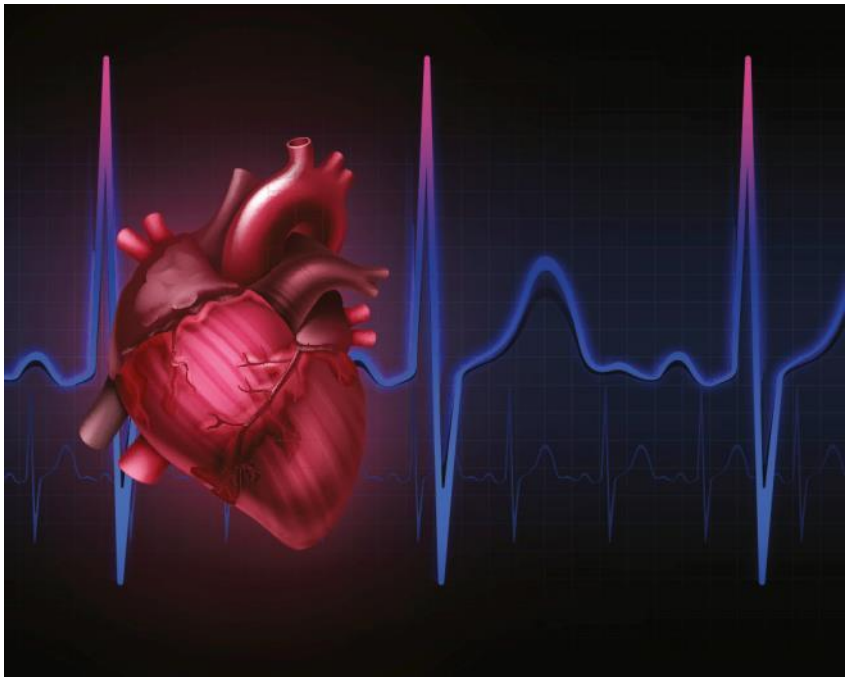
- **Actions**
  - Stimulate the central nervous system to promote bronchodilation; cause direct relaxation of the smooth muscle to the bronchi
- **Uses**
  - Symptomatic relief or prevention of bronchial asthma
  - Treatment of reversible bronchospasm associated with chronic bronchitis and emphysema

Xanthine Derivative Bronchodilators—Adverse Reactions #1

- Central Nervous System Reactions:
  - Restlessness
  - Irritability
  - Headache
  - Nervousness
  - Tremors

Xanthine Derivative Bronchodilators—Adverse Reactions #2

- Cardiovascular System Reactions:
  - Tachycardia
  - Palpations
  - ECG changes
  - Increased respirations



Xanthine Derivative Bronchodilators—Adverse Reactions #3

- Other Reactions:
  - Nausea
  - Vomiting
  - Fever
  - Hyperglycemia
  - Flushing
  - Alopecia

Xanthine Derivative Bronchodilators—Contraindications

- Contraindicated in clients with:
  - Known hypersensitivity to the drugs
  - Peptic ulcers
  - Seizure disorders
  - Serious uncontrolled arrhythmias

Xanthine Derivative Bronchodilators—Precautions

- **Use cautiously in clients with:**
  - cardiac disease
  - hypoxemia
  - hypertension
  - congestive heart failure
  - liver disease
  - older adult
  - habitual alcohol use
  - pregnancy (pregnancy category C) and lactation

Xanthine Derivative Bronchodilators—Interactions #1

Interacting Drug	Common Use	Effect of Interaction
Theophylline		
Charcoal (large amounts)	Neutralize poisoning	Decreased theophylline levels
Hydantoins	Anticonvulsant	Decreased theophylline levels
Ketoconazole	Antifungal agent	Decreased theophylline levels
Rifampin	Antitubercular agent	Decreased theophylline levels

Xanthine Derivative Bronchodilators—Interactions #2

Interacting Drug	Common Use	Effect of Interaction
Theophylline		
Nicotine	Effect from smoking tobacco or aid in cessation	Decreased theophylline levels
Adrenergic agents	Treatment of hypotension and shock	Decreased theophylline levels
Isoniazid	Antitubercular agent	Decreased theophylline levels
Loop diuretics	Treatment of hypertension	Decreased theophylline levels

Xanthine Derivative Bronchodilators—Interactions #3

Interacting Drug	Common Use	Effect of Interaction
Theophylline		
Allopurinol	Antigout agent	Increased theophylline levels
Beta-adrenergic blockers	Treatment of hypertension	Increased theophylline levels
Calcium channel blockers	Treatment of angina and hypertension	Increased theophylline levels
Cimetidine	Treatment of GI problems	Increased theophylline levels
Oral contraceptives	Birth Control	Increased theophylline levels

Xanthine Derivative Bronchodilators—Interactions #4

Interacting Drug	Common Use	Effect of Interaction
Theophylline		
Corticosteroids	Anti-inflammatory agents	Increased theophylline levels
Influenza virus vaccine	Prevention of flu	Increased theophylline levels
Macrolide, quinolone antibiotics	Treatment of infections	Increased theophylline levels
Thyroid hormones	Treatment of hypothyroidism	Increased theophylline levels

Xanthine Derivative Bronchodilators—Interactions #5

Interacting Drug	Common Use	Effect of Interaction
Theophylline		
Isoniazid	Anti-tubercular agent	Increased theophylline levels
Loop diuretics	Treatment of edema	Increased theophylline levels

Pharmacology in Practice Exercise #2

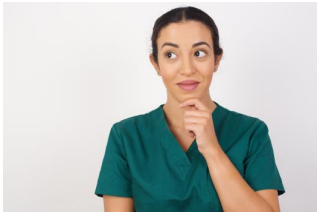
- A client was using a nicotine patch to stop smoking when they were started on theophylline for emphysema. After successfully stopping smoking and ready to stop using the nicotine patch, which of the following would be warranted?

a) Theophylline dose should be decreased

b) Theophylline dose should be discontinued

c) Theophylline dose should be increased

d) Theophylline dose should remain the same



Antiasthma-Specific Drugs: Inhaled Corticosteroids—Actions

- **Actions**
  - given by inhalation and reduce airway hyperresponsiveness
  - Reduce the number of mast cells in the airway
  - Block reaction to allergens
  - Increase the sensitivity of the $ß_2$ receptors; increased the effectiveness of $ß_2$_receptor agonist drugs
  - Beclomethasone and flunisolide decrease inflammatory process directly in the airways

Antiasthma-Specific Drugs: Inhaled Corticosteroids—Uses

- **Uses**
  - Management and prophylactic treatment of inflammation associated with asthma
  - Intranasal treatment of nasal polyps and rhinitis
  - Upper respiratory system conditions

Antiasthma-Specific Drugs: Inhaled Corticosteroids—Adverse Reactions

- Respiratory System Reactions:
  - Throat irritation
  - Hoarseness
  - Upper respiratory tract infection
  - Fungal infection of the mouth and throat

Antiasthma-Specific Drugs: Inhaled Corticosteroids—Contraindications

- Contraindicated in clients with:
  - known hypersensitivity to the drug
  - acute bronchospasm
  - status asthmaticus
  - other acute episodes of asthma

Antiasthma-Specific Drugs: Inhaled Corticosteroids—Precautions

- Use cautiously in clients with:
  - compromised immune systems
  - glaucoma
  - kidney disease
  - liver disease
  - convulsive disorder
  - diabetes
  - pregnancy (pregnancy category B and C) and lactation

Antiasthma-Specific Drugs: Inhaled Corticosteroids—Interactions

Interacting Drug	Common Use	Effect of Interaction
Ketoconazole	Antifungal	Increased levels of budesonide and fluticasone

Mast Cell Stabilizer—Actions and Uses

- **Actions**
  - Thought to stabilize the mast cell membrane, possibly preventing calcium ions from entering mast cells; thus, preventing the release of inflammatory mediators such as histamine and leukotrienes
- **Uses**
  - Treatment of asthma in combination with other drugs
  - Treatment of allergic rhinitis
  - To prevent exercise-induced bronchoconstriction

Mast Cell Stabilizer—Adverse Reactions

- Respiratory System Reactions:
  - Throat irritation and dryness
  - Unpleasant taste sensation
  - Cough or wheeze
  - Can also cause nausea

Mast Cell Stabilizer—Contraindications and Precautions

- Contraindicated in:
  - clients with known hypersensitivity to the drugs
  - acute asthma attacks
- Use cautiously in:
  - pregnancy (pregnancy category B) and lactation
  - impaired renal or hepatic function
- No significant interactions have been reported

Leukotriene Modifiers and Immunomodulators—Actions

- **Actions**
  - Leukotrienes are primarily responsible for bronchoconstriction
  - Zileuton acts by decreasing the formation of leukotrienes
  - Montelukast and zafirlukast inhibit leukotriene receptor sites in the respiratory tract; prevent airway edema and facilitate bronchodilation
  - Omalizumab modulates the immune response by preventing binding of immunoglobulin to the receptors of basophils and mast cells; limits allergic reaction

Leukotriene Modifiers and Immunomodulators—Uses

- Prophylaxis and treatment of chronic asthma in adults and children over the age of 12 years
- Omalizumab is an adjunctive therapy for clients 12 years of age and older sensitive to allergens

Leukotriene Modifiers and Immunomodulators—Adverse Reactions

- Headache
- Flu-like symptoms
- Immunoglobulators can cause anaphylactic reactions

Leukotriene Modifiers and Immunomodulators—Contraindications

- Contraindicated in clients with:
  - known hypersensitivity to the drug
  - acute bronchospasm
  - liver disease (zileuton)
  - lactation
- Use cautiously in clients with:
  - pregnancy (pregnancy category B and C)

Leukotriene Modifiers and Immunomodulators—Interactions

Interacting Drug	Common Use	Effect of Interaction
Aspirin	Pain relief	Increased plasma levels of zafirlukast
Warfarin	Anticoagulant	Increased anticoagulant effect
Theophylline	Treatment of asthma and COPD	Decreased level of zafirlukast; increased serum theophylline levels with zileuton use
Erythromycin	Treatment of bacterial infection	Decreased level of zafirlukast

Nursing Process—Client Receiving a Lower Respiratory System Drug #1

- **Preadministration Assessment**
- **Objective** Data
  - Vital signs (including pulse oximetry)
  - Peak flow meter reading
  - Auscultate breath sounds
  - Description of sputum
  - Signs of hypoxia
  - Cyanosis of skin or mucous membranes
  - Laboratory tests: ABG, PFT

Nursing Process—Client Receiving a Lower Respiratory System Drug #2

- **Preadministration Assessment (continued)**
- **Subjective** Data
  - Type and duration of symptoms
  - Description of any environmental triggers
  - Description of activity disruption by symptoms
  - Health history (especially regarding seasonal allergies or allergens in household)
  - Remedies attempted before seeking care

Nursing Process—Client Receiving a Lower Respiratory System Drug #3

- **Ongoing Assessment—Acute Asthma Attack**
  - Assess the respiratory status about 30 minutes after drug is administered and every 4 hours (or more often if needed) and whenever drug is administered
  - Focused respiratory assessment
  - Keep record of intake and output
  - Report any imbalance
  - After administration observe the client for the effectiveness of the drug

Nursing Process—Client Receiving a Lower Respiratory System Drug #4

- **Ongoing Assessment—**Stable Chronic
  - Client self-monitors
  - Utilize asthma action plan to assess and treat appropriately
  - Nurse asks client about changes seen on the asthma action plan (i.e., have client's status been in the green, yellow, or red zone)
  - Monitor for chest pain and changes in ECG in clients with a history of cardiovascular problems
  - Pulmonary function tests and comparison to baseline

Nursing Process—Client Receiving a Lower Respiratory System Drug #5

- **Nursing Diagnosis**
  - Anxiety related to feelings of breathlessness
  - Ineffective Airway Clearance related to bronchospasm
  - Impaired Oral Mucous Membranes related to dryness or irritation
  - Malnutrition Risk: Less Than Body Requirements related to decreased appetite caused by nausea, heartburn, or unpleasant taste

Nursing Process—Client Receiving a Lower Respiratory System Drug #6

- **Planning**
  - Expected client outcomes depend on the reason for administration of the drug but include:
    - Optimal response to therapy
    - Management of adverse drug reactions
    - Confidence in an understanding of the prescribed medication regimen

Nursing Process—Client Receiving a Lower Respiratory System Drug #7

- **Implementation**
  - Promoting Optimal Response to Therapy
    - Careful monitoring of the client
    - Instruction on proper administration of various drugs

Nursing Process—Client Receiving a Lower Respiratory System Drug #8

- **Implementation**
  - Promoting Optimal Response to Therapy
  - **Quick Relief for Acute Symptom Intervention**
    - Instruct client to administer 2 to 4 puffs of the inhaled SABA when acute distress occurs; up to 3 treatments in 20-minute intervals may be administered
    - Consider the use of nebulized drugs if metered dose inhaler is difficult to use or ineffective for the client
      - ICS and SABA—reduces inflammation and dilates bronchioles
      - Racemic epinephrine—to relieve croup symptoms in children
      - Antibiotics and mucolytics treat lung infections or loosen secretions of cystic fibrosis clients

Nursing Process—Client Receiving a Lower Respiratory System Drug #9

- **Implementation**
  - Promoting Optimal Response to Therapy
  - **Quick Relief for Acute Symptom Intervention (continued)**
    - For a client in an urgent care or emergency care, epinephrine is administered subcutaneously for bronchospasm; minimize distractions while preparing; therapeutic effects last from 5 minutes to 4 hours
    - Rapid theophyllinization is sometimes indicated through loading doses given orally or IV over 12 to 24 hours
    - Monitor client closely for theophylline toxicity
    - Monitor IV site to monitor for extravasation

Nursing Process—Client Receiving a Lower Respiratory System Drug #10

- **Implementation**
  - Promoting Optimal Response to Therapy
  - **Long-Term Control of Symptoms**
    - Teach the client to use the stepwise method of self-care created by the primary health care provider to control respiratory mucosal inflammation
    - Teach the client to refrain from swallowing the ICS's and to rinse the mouth thoroughly after using the inhaler
    - When taking oral corticosteroids, children are at risk for growth reduction so monitor height and weight; older adults are at risk of osteoporosis so calcium and vitamin D supplements may be prescribed

Nursing Process—Client Receiving a Lower Respiratory System Drug #11

- **Implementation**
  - Promoting Optimal Response to Therapy
  - **Long-Term Control of Symptoms (continued)**
    - Teach clients that formoterol comes in a capsule but is administered through an Aerolizer inhaler; do not take orally
    - Mast cell stabilizer cromolyn must be tapered if it is going to be discontinued; when administered orally, must be given 1.5 hours before meals and at bedtime.
    - Oral cromolyn comes in an ampule and is poured into water to administer (do not administer with other liquids)

Nursing Process—Client Receiving a Lower Respiratory System Drug #12

- **Implementation**
  - Promoting Optimal Response to Therapy
  - **Long-Term Control of Symptoms (continued)**
    - Never administer leukotriene receptor antagonists, inhibitors, and immunomodulators during an acute asthma attack (given orally and can worsen the attack)
    - Before giving Zileuton and during therapy review hepatic aminotransferase levels for signs of liver dysfunction
    - Clients are monitored after the injection of mepolizumab (given once a month) in a clinic setting for the development of anaphylaxis; teach client the reaction can occur up to 4 days following the injection

Nursing Process—Client Receiving a Lower Respiratory System Drug #13

- **Implementation**
  - Monitoring and Managing Client Needs
    - **Anxiety**
      - Reassure the client that the medications will help relieve difficulty with breathing
      - Speak and act in a calm manner
      - Closely monitor the client's respiratory rate and blood pressure and report and significant changes

Nursing Process—Client Receiving a Lower Respiratory System Drug #14

- **Implementation**
  - Monitoring and Managing Client Needs
    - **Ineffective Airway Clearance**
      - Check the blood, pressure, pulse, respiratory rate, pulse oximetry, and response to the drug every 5 to 15 minutes until the client's condition stabilizes and respiratory distress is relieved

Nursing Process—Client Receiving a Lower Respiratory System Drug #15

- **Implementation**
  - Monitoring and Managing Client Needs
    - **Impaired Oral Mucous Membranes**
      - Inhalers can cause infection with *Candida albicans*
      - Instruct client to use strict oral hygiene, cleans the inhaler, and use proper technique when taking the inhaled drug
      - Ensure the client brushes teeth daily after treatment

Nursing Process—Client Receiving a Lower Respiratory System Drug #16

- **Implementation**
  - Monitoring and Managing Client Needs
    - **Malnutrition: Less Than Body Requirements**
      - Clients experiencing nausea as an adverse effect should be offered frequent small meals rather than three large meals
      - Meals should be followed by oral care
      - Limit fluids
      - Teach the client and family to have a clean relaxed atmosphere during meals

Nursing Process—Client Receiving a Lower Respiratory System Drug #17

- **Implementation**
  - Monitoring and Managing Client Needs
    - **Malnutrition: Less Than Body Requirements (continued)**
      - Clients taking theophylline can experience heartburn
      - Instruct client to remain in an upright position and sleep with head of bed elevated
      - If the antiasthma drug creates a bad taste in the mouth, instruct the client to take frequent sips of water, suck on sugarless candy, or chew gum

Pharmacology in Practice Exercise #3

- A client complains of nausea after receiving an antiasthma medication. Which of the following instructions should the nurse provide to alleviate the client's symptoms? Select all that apply.

a) Keep the head of the bed elevated

b) Eat frequent small meals

c) Monitor blood pressure closely

d) Limit fluids with meals

e) Rinse mouth properly after eating

Nursing Process—Client Receiving a Lower Respiratory System Drug #18

- **Implementation—Educating the** Client and Family
  - Nurse's role is to instruct the client and family in:
    - methods to monitor the condition
    - control triggers in the environment
    - manage medications properly for optimal breathing

Nursing Process—Client Receiving a Lower Respiratory System Drug #19

- **Implementation—Educating the** Client and Family
- **Teach the Client and Family:**
  - To monitor breathing status and regulate medications based on the asthma action plan
  - How to use a peak flow meter and when to notify the primary health care provider
  - How to use an inhaler or nebulizer correctly and how to care for equipment

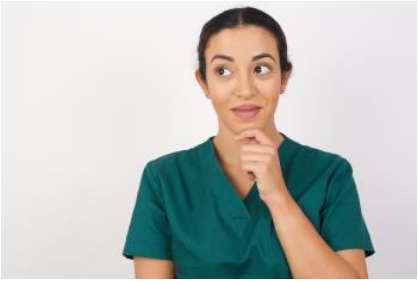
Nursing Process—Client Receiving a Lower Respiratory System Drug #20

- **Evaluation**
  - Was the therapeutic effect achieved and cough relieved?
  - Were adverse reactions: identified, reported, and managed?
    - Anxiety is managed successfully
    - Client has a clear patent airway
    - Mucous membranes are moist and intact
    - Nutrition is adequately maintained
  - Did client and family express confidence and demonstrate understanding of drug regimen?

Turn and Talk—Case Study #1

- A 27-year-old client has been diagnosed with asthma since the age of 8. They present to the physician's office complaining of increased shortness of breath and coughing, especially at night, despite using an albuterol inhaler one or two inhalations every 4 to 6 hours as needed. The physician classifies the client's asthma as Step 3 persistent.

1. What medications are recommended to treat the client's asthma?
2. What environmental controls can the client use to help control the asthma?



Turn and Talk—Case Study #2

- A 27-year-old client has been diagnosed with asthma since the age of 8. They present to the physician's office complaining of increased shortness of breath and coughing, especially at night, despite using an albuterol inhaler one or two inhalations every 4 to 6 hours as needed. The physician classifies the client's asthma as Step 3 persistent.

3. Before the client leaves the office, what should the nurse go over with them?