Goal: To discuss the various types of inhaled devices and educate pharmacists on the techniques for correct device use. After participating in this activity, pharmacists will be able to:

- Describe the various delivery methods for inhaled asthma and COPD medications
- Discuss the use of spacers to enhance technique and delivery of inhaled medications
- Describe proper inhaler techniques and tips for teaching patients to use inhalers and maintaining their competence
- Discuss relevant pediatric considerations with the use of inhalers and nebulizers

**Primer on inhalers and nebulizers**

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**Abstract**

With various delivery methods of asthma and chronic obstructive pulmonary disease (COPD) medications available, pharmacists need to be well versed on the administration and care instructions for each device. Inhaler technique varies depending on the device; therefore, patients may unintentionally misuse an inhaler. Pharmacists are ideally positioned to identify and address nonadherence to prescribed inhaled medications, assess inhaler technique, and provide ongoing education. Pharmacists who engage patients can positively affect asthma and COPD outcomes.

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CPE SERIES: MTM FOR THE PATIENT WITH RESPIRATORY DISEASE

Welcome to the CPE series, Medication Therapy Management for the Patient with Respiratory Disease, which was designed for pharmacists who take care of patients with respiratory disease. Beginning in April 2015 and continuing through December 2015, pharmacists can earn up to 18 hours of CPE credit with 9 monthly knowledge-based activities from the University of Connecticut School of Pharmacy and Drug Topics.

This series kicked off in April and May with MTM essentials for asthma management—Part 1 and Part 2. In June and July, the focus shifts to MTM essentials for chronic obstructive pulmonary disease (COPD) management. The August CE activity is a primer on inhalers and nebulizers. In September, pharmacists have the opportunity to learn about allergic rhinitis management. In October, the CE activity covers MTM essentials for cold, flu, and sinusitis management. The November CE activity includes drug-induced pulmonary disease recognition and management and idiopathic pulmonary fibrosis. The series concludes in December with a focus on MTM essentials for cough management.

The series also offers application-based and practice-based activities in 2016.

The previous continuing education programs in the “Medication Therapy Management for the Patient with Respiratory Disease” series discussed the diagnosis and medical management of asthma and chronic obstructive pulmonary disease (COPD). This program will focus on the numerous delivery methods of available inhaled asthma and COPD medications. Pharmacists must understand the use of these inhaled medications’ devices so that they can appropriately counsel patients on their use. Furthermore, pharmacists should frequently assess inhaler technique to aid patients in achieving optimal health outcomes and increasing quality of life.

**Metered Dose Inhalers**

Metered-dose inhalers (MDIs) are the most common form of inhaled medications for asthma and COPD treatment. Furthermore, the device has been available for decades. Their popularity stems from many advantages, including their portability, multiuse design, consistent dosing, and lessened need for patient preparation as compared to dry powder inhaler (DPI) formulations.

MDIs generally consist of a canister containing the drug and a metering valve, which aids in delivering aerosolized droplets containing drug particles. An actuator boot is used to trigger the medication to escape the canister, and its valve allows a consistent metered dose. Once aerosolized, the shell of the propellant particle becomes smaller with time and distance, thereby reducing particle size. Droplet size is a key factor in proper drug delivery. Particle sizes between 2 and 5 μm offer the best deposition in the bronchial tree. Sizes greater than 5 μm settle in the esophageal region, causing excess drug to be absorbed in the intestines and increasing the potential for adverse effects.

MDIs deliver a mixture of chemical propellant and drug (either as a solution or a suspension), which targets the lower airways of the lungs with a particle size < 5 μm. Excipients aid in stabilizing and solubilizing the drug into solution or suspension. These include surfactants such as sorbitan trioleate or lecithin, which lessen particle agglomeration. Suspension formulations must be shaken to have the active drug solubilize into the gas and achieve uniformity in the canister. Solution formulations do not have this requirement and allow deeper penetration of the drug product because of an extra fine particle size.

A challenge associated with MDI use is the difficulty of achieving coordination between actuation and inspiration. This can be especially difficult for certain patient populations, such as pediatric patients, geriatric patients, and those with poor dexterity. Lack of coordination accounts for approximately half of all administration errors with MDI use. To overcome this problem, a spacer, which allows for maximum lung capacity, the patient should then breathe in slowly while pressing down on the top of the canister until unable to breathe in further.

For the treatment of chronic respiratory diseases, inhaled treatment modalities available as MDIs are divided into two categories: long-term maintenance/controller medications, including inhaled corticosteroids (ICSs) and long-acting beta-2 agonists (LABAs), and rescue medications, including short-acting beta-2 agonists (SABAs) and short-acting anticholinergics (SAACs). Combination products are also available, combining a LABA and an ICS or an SAAC and a SABA (Table 1).

Pharmacists should educate patients about and demonstrate the proper use of MDIs; they should then assess the patient’s use of the medication. Instructions for use are:

1. Once the MDI is removed from the package or foil pouch, the patient should first prime the inhaler; priming should also occur as described based on the product.

2. To use an MDI, the patient should hold the inhaler in one hand, placing his or her thumb and index finger on the base and top of the canister, respectively.

3. The patient should then shake the inhaler for a minimum of five seconds.

4. While sitting or standing up straight, allowing for maximum lung capacity, the patient should then breathe out completely, away from the inhaler.

5. Next, the patient should place the inhaler in the mouth with lips sealed around the mouthpiece, making sure the tongue is flat under the mouthpiece; the patient should then breathe in slowly while pressing down on the top of the canister until unable to breathe in further.

6. The patient should hold the breath for 10 seconds or as long as comfortable before breathing out slowly. If a second inhalation is needed, the patient should wait at least one minute between inhalations.

<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>LABAs, and rescue medications, including short-acting beta-2 agonists (SABAs) and short-acting anticholinergics (SAACs). Combination products are also available, combining a LABA and an ICS or an SAAC and a SABA (Table 1).</td>
</tr>
</tbody>
</table>
By instructing patients that breathing out prior to inhalation and holding their breath as long as is comfortable enhances drug penetration into lungs, the patient will have a greater appreciation for the device’s use and may help proper use and compliance.

7. Lastly, the inhaler should be recapped and placed in a cool dry area.8

If using an MDI that contains an ICS, the patient should rinse his or her mouth out with water after the doses are completed and spit the water out; the water should not be swallowed.

Specific cleaning requirements for MDIs vary among products and depend on whether the product has a removable canister. Albuterol, levalbuterol, and ipratropium MDIs should be cleaned weekly. These products should be cleaned by removing the canister from the plastic holder after the evening use and running warm water through the mouthpiece on both ends for approximately 30 seconds.7,11 Cleaning the holder will improve flow of the product through the mouthpiece. The mouthpiece should be allowed to air dry overnight before it is reassembled. Patients should not wipe off water with a cloth, as this can induce an electrostatic charge on the mouthpiece and lower the amount of drug that reaches the lungs. For single- and combined ICS products, as well as combination ipratropium and albuterol MDIs, the device should be inspected for debris or mouthpiece obstructions at every use and cleaned with a dry cloth weekly.12-18 If a white film covers the actuator nozzle, drug deposition could block the flow of aerosolized drug to the patient; therefore, a damp cotton swab should be used to clean the nozzle, and it should be allowed to dry overnight.

MDIs from various manufacturers are generally considered to be consistent in their instructions for general use with few noted exceptions, such as requirements for priming (Table 1). If a pharmacist notices multiple devices being used by a patient, it is important to educate these patients, as confusion about correct device use is more likely. Furthermore, although MDIs are consistent in the mode of use, differences among products include solution or suspension homogeneity, type of drug, and dose.19 Because consensus on choosing an appropriate inhaler device is lacking, pharmacists have a large role in selecting devices based on patient-specific characteristics.

Pharmacists also have a role in explaining the variety of available MDIs to prescribers, especially when identifying a patient receiving various devices or with an inconsistent order fill history pattern. Inhalers containing dose counters should be selected, if a formulary option. Prescribers should be informed that switching between different inhalers negatively affects care as each device has its own unique instructions for use.3

Table 1: PRiMeR on InHaLeRS and neBuLiZeRS

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**Spacers Devices**

A spacer device, or spacer, provides a reservoir for aerosolized medication and reduces the size and velocity of the aerosolized particles released from MDIs. These changes reduce the deposition of medication in the throat and allow greater delivery of medication to the lungs.20,21 Using a spacer with an ICS reduces local adverse effects such as thrush and hoarseness that are associated with ICS use.21,22

Many spacer options are available, including open tube spacers and valved holding chambers (VHC). Open tube spacers are merely an extension of the MDI’s mouthpiece; therefore, there still is concern regarding coordination of actuation and inhalation to achieve the optimal effect.21 A VHC, on the other hand, has a one-way valve at its mouthpiece, allowing the separation of actuation and inhalation. This feature aids individuals who have difficulty with coordination. Use of a VHC also prevents the patient from exhaling air into the spacer.21,23 Additionally, some spacers have antistatic properties, reducing the adhesion of the medication to the spacer’s walls.22 Lastly, a mask, which can be helpful for elderly patients and children, can be attached to the mouthpiece of a spacer chamber. A mask size should be requested from the mask manufacturer to ensure a correct fit.

After priming the MDI, if needed, or after shaking the MDI before its use, the patient should remove the caps of the spacer’s chamber and the MDI’s mouthpiece. The patient should then attach the MDI’s mouthpiece to the spacer and remove the spacer’s mouthpiece cap. The patient should exhale fully away from the spacer and then place the mouthpiece of the spacer’s chamber in the mouth, between the teeth and with lips sealed around the mouthpiece. The MDI’s canister should be pressed once to release a dose. The patient should slowly and deeply inhale until unable to breathe in further. (Many spacers have a built-in whistle to indicate whether the user is breathing in too quickly. Pharmacists should be sure to instruct patients about the whistle and the goal of not hearing it.) The patient should then remove the spacer from the mouth and hold the breath for 10 seconds or as long as comfortable. If a second dose is needed, the patient should wait at least one minute between doses.24

Generally speaking, to clean the spacer, the patient should take the spacer apart and soak the parts and chamber in warm water with mild liquid soap for a few minutes. The parts should be rinsed under clean running water and then shaken to remove excess water. Patients should not hand dry the chamber or any of the spacer’s parts. All parts should be allowed to air dry (with chamber placed vertically for drying) overnight before they are reassembled.24 Some chambers may be cleaned in the dishwasher; the specific spacer’s instructions for use should be consulted for further details and exact cleaning instructions. Spacers may need to be replaced on a yearly basis; again, the specific spacer’s instructions for use should be consulted for details. An important counseling point is instructing patients not to share spacers.

**Dry Powder Inhalers**

Dry powder inhalers (DPIs) are breath-activated devices that deliver the drug in the form of particles after the puncture of a capsule or blister before use. DPIs constitute a variety of the products available for the treatment of asthma and COPD. Over the past 50 years, numerous DPI devices have been developed and marketed, and there have been many improvements in inhaler characteristics. The increase in popularity of this formulation may be the result of multiple factors, including eliminating the use of propellants and providing a simple inhalation process, thus improving patient adherence.

Inhalers using a dry powder formulation increase the percent of drug delivered to the site of action, which reduces dose variability and lowers the occurrence of systemic and local adverse events.25 DPIs require fast, forceful, and deep inspiratory effort; therefore, successful use may be difficult for some populations, including pediatric and geriatric patients. The degree of resistance to inspira-
Characteristics of Metered-dose Inhalers Available in the United States

<table>
<thead>
<tr>
<th>Medication class(es)</th>
<th>Brand name</th>
<th>Generic name</th>
<th>Number of primes required</th>
<th>When to re-prime (days)</th>
<th>FDA-approved indication(s)</th>
<th>Dose counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICS</td>
<td>Qvar HFA</td>
<td>Beclomethasone</td>
<td>2</td>
<td>&gt;10</td>
<td>Asthma</td>
<td>Yes</td>
</tr>
<tr>
<td>ICS</td>
<td>Alvesco HFA</td>
<td>Ciclesonide</td>
<td>3</td>
<td>&gt;10</td>
<td>Asthma</td>
<td>No</td>
</tr>
<tr>
<td>ICS</td>
<td>Flovent HFA</td>
<td>Fluticasone</td>
<td>4</td>
<td>&gt;7 or when dropped</td>
<td>Asthma</td>
<td>Yes</td>
</tr>
<tr>
<td>SAAC</td>
<td>Atrovent HFA</td>
<td>Ipratropium</td>
<td>2</td>
<td>3</td>
<td>Asthma exacerbation and COPD</td>
<td>Yes</td>
</tr>
<tr>
<td>SABA</td>
<td>ProAir HFA</td>
<td>Albuterol</td>
<td>3</td>
<td>&gt;14</td>
<td>Asthma exacerbation and exercise-induced asthma prophylaxis</td>
<td>Yes</td>
</tr>
<tr>
<td>SABA</td>
<td>Xopenex HFA</td>
<td>Levalbuterol</td>
<td>4</td>
<td>&gt;3</td>
<td>Asthma exacerbation</td>
<td>No</td>
</tr>
<tr>
<td>SABA/LABA</td>
<td>Symbicort HFA</td>
<td>Formoterol and budesonide</td>
<td>2</td>
<td>&gt;7 or when dropped</td>
<td>Asthma and COPD</td>
<td>Yes</td>
</tr>
<tr>
<td>ICS/LABA</td>
<td>Advair HFA</td>
<td>Fluticasone and salmeterol</td>
<td>4</td>
<td>Only if dropped</td>
<td>Asthma and COPD</td>
<td>Yes</td>
</tr>
<tr>
<td>ICS/LABA</td>
<td>Dulera HFA</td>
<td>Mometasone and formoterol</td>
<td>4</td>
<td>&gt;5</td>
<td>Asthma</td>
<td>Yes</td>
</tr>
<tr>
<td>SAAC/SABA</td>
<td>Combivent HFA</td>
<td>Ipratropium and albuterol</td>
<td>3</td>
<td>1</td>
<td>COPD</td>
<td>No</td>
</tr>
</tbody>
</table>

Abbreviations: COPD, chronic obstructive pulmonary disease; HFA, hydrofluoroalkane; ICS, inhaled corticosteroid; LABA, long-acting beta-agonist; SAAC, short-acting anticholinergic; SABA, short-acting beta-agonist.

Table 2: Characteristics of Metered-dose Inhalers Available in the United States

The HandiHaler
The HandiHaler is a disk-style, single-dose device that uses one inserted gelatin capsule per dose. Spiriva HandiHaler (tiotropium inhalation powder), the only medication formulated in the HandiHaler device, is an anticholinergic medication indicated for the long-term, once-daily maintenance treatment of bronchospasm associated with COPD and for the reduction of COPD exacerbations. Each capsule contains a dry powder blend of active drug (18 mcg tiotropium) and the carrier (lactose monohydrate; this should be kept in mind for patients with a lactose allergy). Only a small amount of powder is in each capsule; therefore, the capsules are only partially filled.27

To use the device, the patient must remove the inhaler cap by pressing the green button located on the side of the device. The patient should then pull the lid away from the inhaler to expose the mouthpiece. The patient can then expose the center chamber by pulling the mouthpiece up and away from its base. The patient should then remove one capsule from the blister pack and place in the center chamber of the device. Pharmacists should instruct patients not to swallow the capsules or place them directly into the mouthpiece. The mouthpiece should then be closed until it clicks while the inhaler is held upright. With the mouthpiece in place, the patient should press the green piercing button once until it is flush against the base of the device and then release the button. The green button should not be pressed more than once. The patient should breathe out completely away from the inhaler, then bring the HandiHaler’s mouthpiece to the mouth and close the lips tightly around it. The patient should breathe in steadily and deeply through the mouth with sufficient force to hear the capsule vibrate (rattle). The patient should then remove the mouthpiece from the mouth and hold the breath for as long as comfortable. A second inhalation is required to inhale the remaining contents of the capsule. Once this is completed, the patient should open the mouthpiece, remove the used capsule, and discard it in the trash before closing the mouthpiece and cap of the device.27

The device should be cleaned by rinsing it with warm water. The green piercing button should be pressed a few times so that the center chamber and the piercing needle are under the running water. The patient should ensure that any powder buildup or capsule pieces are removed. The device should be air dried for 24 hours after washing. Capsules should be stored in a dry place between 59°F and 86°F (15°C-30°C) and in the original packaging (not in the device). The beyond-use date for the tiotropium capsules is set by the manufacturer and labeled on the blister packs. Be sure to show patients where the expiration date is located. Patients should be told that a new HandiHaler device is provided with each refill; therefore, used devices should be discarded. There is no need to shake or prime the HandiHaler device before use.

Although an advantage of this device is its size, the need to transport and load capsules for its use may be a limitation. The need to load a capsule for each dose is a constant reminder of how many doses remain.27

Aerolizer
The Aerolizer is a single-dose system that uses gelatin capsules in its drug formulation. Foradil Aerolizer (formoterol inhalation powder) is the only medication indicated for asthma...
and/or COPD that is dispensed as an Aerolizer. Formoterol is a LABA indicated for the treatment of asthma in patients aged at least five years as an add-on to a long-term asthma control medication such as an ICS; the prevention of exercise-induced bronchospasm in patients aged at least five years; and as maintenance treatment for bronchoconstriction in patients with COPD. Formoterol capsules for oral inhalation used with the Aerolizer device are available as 12-mcg doses.28

To use the Aerolizer, the patient should pull off the inhaler cover, hold the base of the inhaler, and twist the mouthpiece in the direction of the arrow to open. The patient should then push the buttons on each side, making sure that all four pins in the capsule well are observed. Then one capsule should be removed from its foil blister and placed in the chamber in the base of the inhaler. Pharmacist should instruct patients not to swallow the capsule or place it directly in the inhaler’s mouthpiece. The mouthpiece should then be twisted back to close. While holding the inhaler upright, the patient should press both buttons on the sides once, at the same time, and then release. The patient should breathe out fully through the mouth, away from the inhaler. The patient should then tilt the head back slightly while keeping the Aerolizer level, with the blue buttons to the left and right (not up and down). The mouthpiece should be placed in between the lips, left and right (not up and down). The mouthpiece should be held for 10 seconds or as long as comfortable before the patient breathes out gently away from the inhaler. The chamber should be opened to see if any powder remains in the capsule. If so, the patient should close the chamber, and repeat the inhalation process. There is no recommended wait time if multiple inhalations are needed to inhale the remaining powder. The inhalation process must be repeated several times before the capsule is completely emptied. Once no powder remains, the patient should discard the capsule from the compartment and replace the cap.26

After each usage, a new capsule needs to be inserted; thus, use of the Aerolizer may not be convenient for some patients. There is no need to shake or prime this device before use. Because this is a single-dose system, there is no dose counter. The Aerolizer device is disposable and should never be taken apart. To keep the Aerolizer clean, the patient should wipe the mouthpiece with a dry tissue (never with water). Before dispensing, medication should be stored in a refrigerator (36°F-46°F[2°C-8°C]). After dispensing, medication should be stored at room temperature (68°F-77°F[20°C-25°C]) and away from heat and moisture. Capsules should always be stored in the blister and only removed immediately before use. The beyond-use date is four months after the medication is dispensed. Pharmacists should have patients write down the “use by” date after opening the medication. With every refill, patients will receive a new Aerolizer; therefore, patients should be instructed to always use the device that is provided with each refill.28

Neohaler

The Neohaler device is a single-dose system similar in structure to the Aerolizer. Similarly, the Neohaler uses gelatin capsules that need to be pierced to deliver the medication. Importantly, the Neohaler uses sensory cues, including the sound of whirring during inhalation, the taste of a subtle flavor, and the sight of an empty capsule to help patients know that the inhaler was used correctly.29

Arcapta Neohaler (indacaterol inhalation powder), the only product which uses the Neohaler device, is a LABA indicated for the long-term, once-daily maintenance bronchodilator treatment of airflow obstruction in patients with COPD, including chronic bronchitis and/or emphysema. Each capsule contains 75 mcg of indacaterol.

To use the device, the patient should remove the cap, holding the base of the inhaler firmly while tilting the mouthpiece. When the patient is ready, one capsule should be removed from the blister by pushing the capsule through the foil. Pharmacists should instruct patients not to swallow the capsule or place it directly into the mouthpiece. The capsule should be placed into the capsule chamber, which should then be closed. A “click” sound will be heard when the chamber is closed. While holding the inhaler upright, the patient should press both buttons on the side simultaneously until a “click” is heard, then release the buttons (only pressing the buttons once). The patient should breathe out fully through the mouth, away from the inhaler, before placing the mouthpiece in the mouth with lips tightened around it. The patient should hold the inhaler with the buttons to the left and right (not up and down), then breathe in rapidly and steadily through the mouth. A whirring noise should be heard. Then the patient should hold the breath for as long as comfortably possible after removing the inhaler from the mouth. The inhaler should be opened to see if any powder remains in the capsule. If so, the patient should close the inhaler and repeat the inhalation process. Once all of the contents of the capsule are inhaled, the patient should tilt the mouthpiece open, remove the used capsule, and discard it in the trash. The mouthpiece should then be closed and the cap should be placed on the device.29

Cleaning the device is not necessary; but if the patient wishes, he or she can wipe the inhaler between uses with a clean, dry, lint-free cloth or soft brush. The patient should ensure that any powder buildup or capsule pieces are removed. Occasionally, very small pieces of the capsule can get past the screen and enter the mouth. If this happens, the patient may be able to feel the pieces on the tongue. It is not harmful if these pieces are swallowed or inhaled. The chance of the capsule shattering is increased if the capsule is pierced more than once; therefore, the capsule should be removed from the blister pack immediately before use and pierced only once. Furthermore, using the new device obtained with each refill will ensure that the piercing pins do not become dull. Capsules should always be stored in the blister packaging in a dry location between 59°F and 86°F (15°C-30°C), away from light and moisture. The beyond-use date is specified by the manufacturer on the capsule’s packaging.29

Because of the similarities between the Neohaler and the Aerolizer, it is important for pharmacists to notify patients that only the medication provided with the device can be used. Like other single-unit dose device capsules, indacaterol capsules should not be stored in the device or directly in the mouthpiece. Patients should be reminded to pay attention to the sensory cues to ensure that the device is used properly.29

Pressair

Pressair is a preloaded, multidose system equipped with multiple feedback mechanisms to notify the patient if the inhalation process was carried out correctly. This device has a
Characteristics of Dry Powder Inhalers Available in the United States

<table>
<thead>
<tr>
<th>Brand Name and Dosage Form</th>
<th>Generic Name</th>
<th>Type of DPI Device</th>
<th>Dose Counter</th>
<th>Sensory Cue</th>
<th>Cleaning</th>
<th>Beyond Use Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spiriva HandiHaler</td>
<td>Tiotropium</td>
<td>Single-unit Dose</td>
<td>No</td>
<td>Yes</td>
<td>Rinse the inhaler with warm running water. Leave open to air dry for 24 hours.</td>
<td>Manufacturer’s expiration date on the capsules’ packaging</td>
</tr>
<tr>
<td>Foradil Aerolizer</td>
<td>Formoterol</td>
<td>Single-unit Dose</td>
<td>No</td>
<td>Yes</td>
<td>Not required; can wipe mouthpiece with a dry tissue</td>
<td>4 months from the dispensed date</td>
</tr>
<tr>
<td>Arcapta Neohaler</td>
<td>Indacaterol</td>
<td>Single-unit Dose</td>
<td>No</td>
<td>Yes</td>
<td>Not required; can wipe inhaler with clean, dry, lint-free cloth or soft brush</td>
<td>Manufacturer’s expiration date on the capsules’ packaging</td>
</tr>
<tr>
<td>Tudorza Pressair</td>
<td>Aclidinium</td>
<td>Multidose Reservoir</td>
<td>Yes</td>
<td>Yes</td>
<td>Not Required; can wipe mouthpiece with a dry tissue or paper towel</td>
<td>45 days after removal from foil pouch</td>
</tr>
<tr>
<td>Asmanex Twisthaler</td>
<td>Mometasone</td>
<td>Multidose Reservoir</td>
<td>Yes</td>
<td>No</td>
<td>Wipe the mouthpiece with a dry cloth or tissue after each use</td>
<td>45 days after removal from foil pouch</td>
</tr>
<tr>
<td>Pulmicort Flexhaler</td>
<td>Budesonide</td>
<td>Multidose Reservoir</td>
<td>Yes</td>
<td>No</td>
<td>Wipe the mouthpiece with a dry tissue weekly</td>
<td>6 months after removal from the original pouch</td>
</tr>
<tr>
<td>ProAir RespiClick</td>
<td>Albuterol</td>
<td>Multidose Reservoir</td>
<td>Yes</td>
<td>No</td>
<td>Not Required</td>
<td>13 months after removal from foil pouch</td>
</tr>
<tr>
<td>Advair Diskus</td>
<td>Fluticasone/ salmeterol</td>
<td>Multiunit Dose</td>
<td>Yes</td>
<td>No</td>
<td>Not Required; can wipe mouthpiece with clean, dry cloth</td>
<td>1 month after removal from foil pouch</td>
</tr>
<tr>
<td>Flovent Diskus</td>
<td>Fluticasone</td>
<td>Multiunit Dose</td>
<td>Yes</td>
<td>No</td>
<td>Not Required; can wipe mouthpiece with clean, dry cloth</td>
<td>50 mcg: 6 weeks after removal from pouch 100 mcg and 200 mcg: 2 months after removal from foil pouch</td>
</tr>
<tr>
<td>Serevent Diskus</td>
<td>Salmeterol</td>
<td>Multiunit Dose</td>
<td>Yes</td>
<td>No</td>
<td>Not Required; can wipe mouthpiece with clean, dry cloth</td>
<td>6 weeks after removal from foil pouch</td>
</tr>
</tbody>
</table>

Abbreviation: DPI, dry powder inhaler

Source: Ref 27-35, 42

Dosage-stop system that only allows the release of a subsequent dose only after the previous dose has been inhaled correctly. The colored control window provides confirmation of a successful inhalation. The window turns from red to green when the dose is ready and from green to red when the patient has inhaled the full dose of medication correctly. The device also produces a “click” sound during inhalation when the patient is using the inhaler correctly.

Tudorza Pressair (aclidinium inhalation powder), the only product available using the Pressair device, is an anticholinergic medication indicated for the maintenance treatment of bronchospasm associated with COPD, including chronic bronchitis and emphysema. There is 400 mcg of aclidinium per actuation. Because the Pressair device is very different from the other DPIs, it is important that pharmacists counsel patients on how to correctly use this device.

To use the Pressair device, the patient must remove the protective cap by lightly squeezing the arrows marked on each side of the cap and pulling. The patient should hold the inhaler with the mouthpiece facing the mouth and the green button on the top. The green button should be pressed all the way down before releasing. The patient should breathe out completely through the mouth, away from the inhaler. At this point, the patient should stop and check the control window to make sure that the dose is ready for inhalation. If the colored control window has changed from red to green, the mouthpiece is ready for inhalation. If the window remains red, the patient should press down on the green button and release. After the window has turned green, the mouthpiece should be placed in the mouth with the lips tightened around it. The patient should breathe in, and on hearing a “click” sound, should continue breathing in to be sure to receive the full dose. Then the patient should remove the inhaler from the mouth and hold the breath for as long as comfortably possible. It is important to check the control window to make sure that the inhaler was used correctly. If the window is red, the full dose of medicine was inhaled correctly. If the window is not red, the patient may have forgotten to release the green button before inhaling or may not have inhaled correctly. After correct use, the patient should replace the cap on the device. Pharmacists should inform patients that the dose counter decreases after each successful inhalation and counts down in intervals of 10, so patients will need to schedule refills accordingly to maintain adherence.

Pharmacists should explain to patients that the device comes ready to use after a three-step process: press, release, and inhale. Before using the device, the patient must be sure that the green button is pushed all the way down and then released. Pharmacists should also educate patients about the provided feedback during use. For instance, the full dose of medicine is inhaled when they hear the “click” and see the inhaler’s window change colors from green to red. It is important that patients do not stop inhaling after they hear the “click,” but continue to inhale until the color window turns red.

Patients do not need to clean the Pressair inhaler; however, the outside of the mouthpiece can be wiped with a dry tissue or paper pouch.
It is important to keep the inhaler clean and dry at all times. The inhaler should not be washed with water. The device should be stored in a dry place between 59°F and 86°F (15°C-30°C). The dose counter on the colored base shows the number of doses left for use. The inhaler should be thrown away 45 days after it is removed from the foil pouch or when the dose counter reads “00” (comes after “01”), indicating that the final dose has been inhaled, whichever comes first. Pharmacists counseling patients on using the Twisthaler should remind them that the medication is ready for use as soon as the cap is twisted off and there is no need to preload the medication. As with other DPIs, a spacer should not be used with this device.

**Flexhaler**

The Flexhaler is a multidose reservoir inhaler that replaced the Turbuhaler (no longer marketed). There are a number of differences between the products. For example, the Flexhaler’s mouthpiece has little grooves almost an inch from its tip to prevent patients from placing the inhaler too far into the mouth. It also has a red marker dose indicator; its open window with numbers notifies the patient of remaining doses, counting down by 10.

Pulmicort Flexhaler (budesonide inhalation powder), the only medication formulated in the Flexhaler device, is indicated for the maintenance treatment of asthma in adult and pediatric patients aged more than six years. This medication is available as a Flexhaler in 90-mcg/inhalation and 180-mcg/inhalation strengths.

Before use, the Flexhaler needs to be primed. To prime, the patient should hold the device upright and unscrew the white cover. Next, the patient should turn the brown bottom of the Flexhaler all the way to the right and back to the left. If this is done correctly, the device will produce a “click” sound. To complete the priming process, the patient must turn the brown bottom all the way to the right and back to the left one more time. The Flexhaler is now ready for use. Pharmacists should notify patients that no additional priming is necessary even if the device is not used for a long period of time.

To use the device to deliver a dose, the patient should hold the inhaler upright by the brown grip base and remove the cap. While holding the inhaler in the middle, the patient should twist the brown grip as far as it will go in one direction and then back in the other direction until it clicks. The patient should breathe out fully through the mouth, away from the inhaler, before sealing the lips around the mouthpiece. The patient should then breathe in deeply and forcefully through the mouth, then remove the inhaler from the mouth and exhale away from the mouthpiece. If multiple subsequent inhalations are required, the patient should repeat these steps, starting with twisting the brown grip. After use, the patient should replace the cap on the inhaler, rinse the mouth with water, and spit the water out. Patients should be informed that they may not feel any medication when they are inhaling; however, this does not mean that the medication was not delivered.

Unlike the other DPIs, the Flexhaler device needs priming before its initial use. Furthermore, the inhaler will only provide one dose at a time, no matter how often a patient clicks the brown grip; however, the dose indicator count will continue to decrease. Because of this, it is possible for the indicator to show fewer doses or zero doses even if more doses remain. Once the counter reaches zero, the inhaler may not deliver the correct amount of medication, even though it may not feel completely empty and may seem like it continues to work. Notifying patients that they must obtain a refill before the device reaches zero is important to maintain patient adherence. The beyond-use date for the Flexhaler is six months after it is removed from the original pouch or when the dose counter window shows “0,” whichever comes first. To maintain a clean device, the patient should wipe the outside of the mouthpiece weekly with a dry tissue; water or liquids should not be used when cleaning the mouthpiece. The device should be stored in a dry place at room temperature (59°F-86°F [15°C-30°C]). As with other DPIs, spacers should not be used, and the inhaler is disposable after use. Patients should not attempt to open the inhaler.

**Diskus**

The Diskus is a blister-pack, multiunit dose device that provides a sealed uniform dose of medication lasting a month. Each Diskus consists of a coiled, double-foil strip of 14, 28, or 60 blisters; each contains one dose with a lactose carrier. There are currently three medications formulated and available...
The characteristics of Ellipta devices available in the United States

<table>
<thead>
<tr>
<th>Generic and Brand Name</th>
<th>Indication(s)</th>
<th>Considerations for use (applicable to all)</th>
<th>Cleaning and storage (applicable to all)</th>
</tr>
</thead>
<tbody>
<tr>
<td>umclidinium/vilanterol (Anoro)</td>
<td>Combination of anticholinergic and LABA indicated for: Long-term, once-daily maintenance treatment of COPD</td>
<td>Shake before use: No Prime: No Dose counter: Yes Multiple subsequent inhalations: One inhalation once daily for all Ellipta medications Beyond-use date: Discard all Ellipta inhalers 6 weeks after opening the foil tray or when the counter reads “0” (after all blisters have been used), whichever comes first. The inhaler is not reusable. Do not attempt to take the inhaler apart.</td>
<td>Clean the mouthpiece if needed, using a dry tissue, before closing the cover. Routine cleaning is not required. Do not clean or rinse with water. Store at room temperature between 68°F and 77°F (20°C and 25°C). Store in a dry place away from direct heat and sunlight.</td>
</tr>
<tr>
<td>fluticasone/vilanterol (Breo)</td>
<td>Combination of ICS and LABA indicated for: Long-term, once-daily maintenance treatment of COPD Long-term, once-daily maintenance treatment of asthma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fluticasone (Arnuity)</td>
<td>ICS indicated for: Long-term, once-daily maintenance treatment of asthma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>umclidinium (Incruse)</td>
<td>Anticholinergic indicated for: Long-term, once-daily maintenance treatment of COPD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: LABA, long-acting beta agonist; COPD, chronic obstructive pulmonary disease; ICS, inhaled corticosteroid.

Source: Ref 38-42

As a Diskus device approved for the treatment of asthma and/or COPD, Advair Diskus (fluticasone and salmeterol inhalation powder) is a combination product that contains an ICS and a LABA. This product is indicated for the treatment of asthma in patients aged at least four years and for the maintenance treatment of airflow obstruction and the reduction of exacerbations in patients with COPD. It is currently available in three strengths (100 mcg/50 mcg, 250 mcg/50 mcg, and 500 mcg/50 mcg). Flovent Diskus (fluticasone inhalation powder) is an ICS indicated for the treatment of asthma in patients aged at least four years. This product is available as a Diskus in three strengths (50 mcg, 100 mcg, and 250 mcg). Seretide Diskus (salmeterol inhalation powder) is indicated for the treatment of asthma in patients aged at least four years, the prevention of exercise-induced bronchospasms in patients aged at least four years, and the maintenance treatment of bronchospasm associated with COPD. It is available as a Diskus in one strength (50 mcg).

To use the Diskus, the patient should open it by placing his or her thumb in the thumb grip and pushing away until the lever from left to right until it “clicks.” The dose counter will be reduced by one, letting the patient know that the device is ready for use. Next, the patient should breathe out fully through the mouth, away from the inhaler, and place the mouthpiece between the lips. The patient should breathe in quickly and deeply, not through the nose. After inhalation, the patient should remove the device from the mouth and hold the breath for as long as comfortably possible, up to 10 seconds, before breathing out slowly. The patient should then use the thumb grip to close the inhaler. When using a Diskus that contains an ICS, the patient should rinse his or her mouth with water after inhaling the dose, then spit out the water.

Pharmacists should instruct patients that inhalations should be separated by approximately 12 hours. Two inhalations should not be taken at the same time. The counter on the top of the device shows how many doses are left. The numbers five through zero appear in red, notifying the patient to request a refill. Cleaning of this device is not required; however, patients can wipe the mouthpiece with a clean dry cloth if needed. The device should not be rinsed or cleaned with water. The device should be stored at room temperature (68°F-77°F [20°C-25°C]) in a dry place away from heat and sunlight. Before the initial use, the device should be stored in the unopened foil pouch, which should be opened only when ready for use. Because these medications have different beyond-use dates, pharmacists should stress the importance of having patients write the date that the foil pouch is opened on the first blank line and the “use-by” date on the second blank line, both found on the device. For the fluticasone and salmeterol combination Diskus, the beyond-use date is one month after removal from the foil pouch. The salmeterol Diskus has a beyond-use date of six weeks after it is removed from the foil pouch. The beyond-use date for the fluticasone Diskus varies based on strength. For 50 mcg, the beyond-use date is six weeks after removal from the pouch; for 100 mcg and 250 mcg, the beyond-use date is two months after removal from the pouch. When the Diskus is first used, the dose counter reads “60” (unless it is an institutional pack). No matter the medication or strength, when the device reads zero, it should be discarded.

When patients are using the Diskus, it is important that they do not take an extra dose. Pharmacists should notify patients that even if they did not taste or feel the powder when inhaling, it does not mean that no medication was dispensed. Pharmacists should advise patients to write down the open date and “use-by” date on the diskus, as even though the dose counter may indicate that medication remains in the device, if the “use-by” date has passed, a new Diskus is necessary. Patients should be reminded that the device is disposable and should not be taken apart. Pharmacists should advise the patient to never wash the Diskus and to store it in a dry place. Patients who take multiple medications, including MDIs, may be accustomed to using spacers. The Diskus should not be
used with a spacer. Lastly, the dose counter makes it easy to know when it is time for a refill. Pharmacists should notify patients of this feature and be sure that they recognize the need to request refills before the counter reaches zero.33,35

**Ellipta**

Ellipta is the one of the newer multidose devices on the market. Unlike the Diskus, the Ellipta contains two separate blister strips from which the inhalation powder is delivered in a simple method. It also has a large, easy-to-read dose counter. There are currently four medications formulated using the Ellipta device. They include Anoro Ellipta (umeclidinium and vilanterol inhalation powder), Breo Ellipta (fluticasone and vilanterol inhalation powder), Amnity Ellipta (fluticasone inhalation powder), and Incruse Ellipta (umeclidinium inhalation powder) (Table 3).36,37

The combination of fluticasone and vilanterol was the first product approved and available in the Ellipta device. It is a combination of an ICS and a LABA and is indicated for the long-term, once-daily maintenance treatment of airflow obstruction and for the reduction of exacerbations in patients with COPD. This is also indicated for the once-daily treatment of asthma in patients aged at least 18 years. Currently, there are two strengths available (100 mcg/25 mcg and 200 mcg/25 mcg).38 Umeclidinium plus vilanterol inhalation powder is an combination of an anticholinergic and a LABA and is indicated for the long-term, once-daily maintenance treatment of airflow obstruction in COPD. This product is available in a dose of 62.5 mcg/25 mcg.39 The two newest Ellipta devices on the market are single-dose products and include fluticasone inhalation powder (100 mcg or 200 mcg) and umeclidinium inhalation powder (62.5 mcg).40,41

To use the Ellipta device, the patient should slide the cover down to expose the mouthpiece. It will “click” and decrease the counter by one; the device is now ready for use. There is no need to shake or prime the Ellipta device. While holding the inhaler away from the mouth, the patient should breathe out fully. The patient should then place the mouthpiece between the lips, making sure the air vents are not blocked. The patient should breathe in deeply and slowly through the mouth before removing the device from the mouth. The breath should be held for three to four seconds or for as long as comfortably possible. The patient should breathe out slowly away from the inhaler and then close the inhaler by sliding the cover over the mouthpiece. If using a product that contains an ICS, the patient should rinse his or her mouth with water after use and spit the water out.38,41

There are a number of key counseling points pharmacists should discuss with patients using an Ellipta device. All medications formulated in the Ellipta device have the same beyond-use date. Patients should write the “Tray opened” and “Discard” dates on the inhaler label. The “Discard” date is six weeks from the date the tray was opened. The device is equipped with a dose counter that indicates the number of remaining doses. When there are 10 or fewer doses remaining, the left side of the dose counter turns red, indicating that it is time for a refill. The Ellipta device does not require routine cleaning; however, the mouthpiece can be cleaned with a dry tissue. Pharmacists should instruct patients to keep the device dry and to store it in a dry place at room temperature (68°F-77°F [20°C-25°C]), away from direct heat or sunlight. If the inhaler’s cover is opened and closed without the medication being inhaled, the dose is lost. The lost dose is held in the inhaler but is no longer available for inhalation. This makes receiving an extra dose impossible. Each refill provides the patient with a new inhaler. No spacers should be used with the Ellipta device.38,41

All medications formulated in the Ellipta device are dosed once daily; therefore, there is no need for multiple subsequent inhalations. Recent clinical trials have shown the potential benefits of using Ellipta inhalers, including its once-daily dosing and ease of use, compared with other devices currently on the market.40,41 Given this, patients may be switching from inhalers requiring twice-daily administration; therefore, pharmacists must notify patients that any medication formulated in an Ellipta device is closed once daily.38,41

**RespiClick**

The RespiClick is the newest multi-dose, breath-actuated DPI on the market. Furthermore, ProAir RespiClick (albuterol sulfate) is the only dry powder SABA indicated for patients 12 years of age and older for the treatment or prevention of bronchospasm. The inhaler supplies 200 inhalations, with each delivering 108 mcg of albuterol sulfate.42

To use the RespiClick, instruct the patient to hold the inhaler upright and open the cap fully, until hearing a “click,” which signifies the inhaler is ready for use. Next, breathe out completely through the mouth, away from the inhaler. Place the mouthpiece in the mouth and tighten the lips around it; taking care not to block the vent located above the mouthpiece. Breathe in deeply before removing the inhaler from the mouth. Hold the breath for 10 seconds or as long as comfortably possible; then breathe out away from the inhaler. Check the dose counter to ensure the dose was received. Be sure to always close the cap after each inhalation, so the inhaler is ready for its next use. If another inhalation is needed, repeat the steps described above.42

The RespiClick contains a dose counter in the back of the inhaler with a viewing window that indicates remaining doses. When there are 20 doses remaining, the dose counter will change to red notifying the patient to refill the medication. Pharmacists should notify patients that the RespiClick does not have an activation button or removable canister. Rather, when the cap is opened, the dose is ready for delivery; therefore, the patient should be instructed to only open the cap when ready to administer the medication. The device’s expiration date is either 13 months after removing the device from the foil pouch, when the dose counter displays “0,” or after the expiration date found on the package, whichever comes first. Pharmacist should instruct patients to not wash or put any part of the device in water. If cleaning is necessary, wipe the mouthpiece with a dry cloth or tissue. The RespiClick should be stored at room temperature between 59°F and 77°F (15°C and 25°C); avoid exposure to humidity or extreme heat or cold. It is easy for patients to confuse this medication with MDI inhalers containing albuterol; therefore, pharmacists should explain the difference in use, including no need to shake or prime this device.42

Pause & Ponder

**How can you incorporate device instruction into your daily practice to ensure correct inhaler technique?**
Soft Mist Inhaler

The soft mist inhaler is a newer dosage form that produces a metered dose of drug solution through a nozzle with two jets of mist. The mist contains a particle fraction of 65% to 80%, higher than both MDI and DPI devices. Its design was intended to improve a problem associated with MDIs: the difficulty of coordinating the release of the drug with inhalation. The soft mist produced lasts approximately 1.5 seconds, helping the patient to achieve a higher degree of coordination. Additionally, the deposition and amount of drug delivered are not dependent on a patient’s respiratory effort.43

Respimat

In the United States, three products are currently formulated in the Respimat device and FDA approved for use in COPD. These include the combination of ipratropium and albuterol (Combivent), olodaterol (Striverdi), and tiotropium (Spiriva).44-46

Before the first use of the device, the patient should take the inhaler out of the box and remove the clear base while pushing down on the safety catch.44-46 The patient should then insert the metal cartridge into the inhaler with its narrow end pointing up. The cartridge should be pressed on a firm surface to ensure full insertion. (Note that one-eighth of an inch of the cartridge remains visible even when the cartridge is fully inserted.)49

Next, the patient should wipe the discard date, which is three months after installing the cartridge into the device, on the white label where indicated.44 Then the patient should attach the base into place until it “clicks.” Once this process is completed, the inhaler should not be disassembled.44

To prime the device, the patient should hold the inhaler upright with the cap closed and on top. The clear base should be turned in the direction of the black arrows found on the label until it “clicks.” The patient should flip the cap open, point the top of the inhaler toward the ground, and press the release button; a spray should be visible. This priming process should be repeated three more times.44 Pharmacists should inform patients that the priming process will not affect the amount of medication in the device.

To use the inhaler, the patient should hold the device upright and turn the base in the direction of the arrows (one half turn) until it “clicks.” The cap should be flipped until it snaps fully open. The patient should breathe out fully away from the inhaler and then place the mouthpiece in the mouth, tightening the lips around it and ensuring that the air vent (located on the side of the mouthpiece) is not covered.44 Next, the patient should press the dose release button and inhale deeply and slowly through the mouth. The breath should be held for 10 seconds or for as long as comfortable. If multiple inhalations are needed, the patient should wait at least one minute between inhalations to maximize drug exposure in the airways. The cap should then be replaced. An easy way to teach a patient about the proper use of this device is by using the acronym TOP: Turn the base, Open the cap and close your lips around the mouthpiece, Press the dose-release button and inhale.44

If the inhaler has not been used in three days, the patient should release one puff to prepare it for use. If the device has not used within 21 days, the product should be primed (as described above).44 To clean the device, the patient should wipe the metal part inside the mouthpiece and the outside plastic mouthpiece once weekly with a damp cloth or tissue while checking for obstructions in the mouthpiece. Pharmacists should also discuss how the dose indicator works with patients. The red needle found within the plastic indicator points to either a green or red band. When the needle points toward the green band, there is an adequate number of doses remaining.46 When the needle points to the red band, there is enough medicine for seven days; therefore, patients should be instructed to request a refill at this time.46

When the device is empty, it will automatically lock and the patient will be unable to depress the release button. An inhaler will last the patient for approximately one month of use.

Other Considerations

For all patients using an inhaled medication, correct administration technique is essential. Pediatric patients may experience difficulty using the devices correctly or may be hesitant to use the devices. Using a nebulizer, an electrical device which transforms a solution or suspension medication into particles inhaled via a tube or mask, eliminates the need for actuation and inhalation coordination, a common barrier for pediatric patients. The transformation of medication into particles provides good medication deposition in the lungs. Two types of nebulizers, jet and ultrasonic, are available. A jet nebulizer uses compressed air; whereas, an ultrasonic nebulizer uses high-frequency ultrasonic waves to generate the medication mist. Nebulizers have multiple components including an air compressor, nebulizer cup, measuring device, tubing, and a mouthpiece or mask. They also require assembly and either batteries or electricity for operation.47,48 Using a nebulizer with a well-fitted mask may be an option, especially for young children; however, nebulizer use has drawbacks. These include increased administration time, noise, cost, and lack of portability.49 Alternatively, using a spacer with an MDI device can alleviate the problem of coordinating actuation and inhalation and aid in disease state management.

A recent review supports the use of a VHC spacer with an MDI instead of a nebulizer, given its limitations.49

For pediatric and adult patients alike, ongoing education is key. Research has demonstrated that 40% to 80% of provided medical information is forgotten by patients immediately; additionally, for the information that is retained, up to 50% is recalled incorrectly.50-54 Pharmacists are ideally positioned to aid in mitigating these staggering numbers. Providing ongoing education not only about device use and care but also about asthma management and administration technique is key. Additionally, given that DPIs are generally not recommended for use in children under the age of 5, pharmacists need to provide ongoing counseling and engage the patient in direct observation to ensure correct device use.47 For pediatric patients, parents and other caregivers must be educated; the patients themselves can also be educated at an appropriate level, given patient age.

A written asthma action plan developed in collaboration with the primary care provider is an essential component of the asthma care plan for all diagnosed. This plan should detail the treatment steps when asthma worsens. The plan should be shared with those who care for pediatric patients, including day care staff and school nurses.20,52

Pharmacy staff, including technicians, can identify patients who may have poorly controlled asthma and/or COPD by evaluating refill patterns. Patients who frequently refill rescue medications (i.e. SABAs) likely have poor asthma control. Additionally, patients who are on a controller medication should be consistently refilling the medication(s). After identifying pa-
tients who are refilling their medications either too frequently or not frequently enough, pharmacists can discuss asthma and/or COPD management with patients one-on-one. In doing so, pharmacists can determine whether patients need to step up in therapy.53 Given the variety of available devices, it is important to maintain consistency in device use, as patients with asthma or COPD may be unaware of unintentional nonadherence due to a poor understanding of use of their inhaler device(s). Pharmacists, as members of the interdiscipli- nary care team, are well trained and ideally positioned to assess device use, provide ongoing education, evaluate refill patterns, and assess and recommend respiratory medication regimens. Patient engagement in the management of respiratory diseases is essential. With frequent patient contact and the development of a pharmacist-patient relationship, pharmacists have the ability to positively affect patient care and health outcomes with respect to respiratory diseases.

The references are available online at www.drugtopics.com/cpe.

### TEST QUESTIONS

1. Which of the following medications is formulated in a single-dose dry powder inhaler?
   a. Albuterol  
   b. Indacaterol  
   c. Mometasone  
   d. Umeclidinium

2. Which of the following medications is formulated in a metered-dose inhaler?
   a. Albuterol  
   b. Indacaterol  
   c. Mometasone  
   d. Umeclidinium

3. Which of the following is a limitation of a metered-dose inhaler?
   a. Cost  
   b. Multiuse  
   c. Portability  
   d. Need for coordination

4. Patients who use an inhaler that contains an inhaled corticosteroid should be counseled about which of the following?
   a. Need for frequent blood glucose monitoring  
   b. Need for calcium and vitamin D supplementation  
   c. Need to rinse mouth with water and swallow after inhaler use  
   d. Need to rinse mouth with water and spit water out after inhaler use

5. To clean an albuterol inhaler, a patient should:
   a. Remove the canister and float it in water  
   b. Wash the canister and holder with water  
   c. Remove the canister and wash the holder with water  
   d. Inspect the mouthpiece for obstructions and wipe with a dry cloth

6. Which of the following is a benefit of using a spacer with a metered-dose inhaler?
   a. Increases medication deposition in the lungs  
   b. Increases medication adhesion to its walls  
   c. Increases particle velocity  
   d. Decreases inhalation time

7. Patients should be instructed to inhale a dry powder inhaler:
   a. Gently  
   b. Slowly  
   c. Quickiy  
   d. At a usual breathing rate

8. Which of the following is a benefit of using a dry powder inhaler?
   a. Low cost  
   b. Single use of device  
   c. Ease of use for all  
   d. Increased drug delivery to the site of action

9. Which of the following dry powder inhaler devices requires the insertion of a capsule for use?
   a. Ellipta  
   b. Flexhaler  
   c. HandiHaler  
   d. Pressair

10. Which of the following dry powder inhaler devices provides sensory cues alerting the patient that the device was used correctly?
    a. Aerolizer  
    b. HandiHaler  
    c. Neohaler  
    d. Twisthaler

11. Which of the following dry powder inhaler devices can be washed in water?
    a. Aerolizer  
    b. Ellipta  
    c. HandiHaler  
    d. Neohaler

12. Which of the following dry powder inhaler devices should be stored in the refrigerator before dispensing?
    a. Aerolizer  
    b. Ellipta  
    c. HandiHaler  
    d. Neohaler

13. Which of the following dry powder inhaler devices provides multiple feedback mechanisms notifying the patient that the inhalation was carried out correctly?
    a. Ellipta  
    b. Pressair  
    c. Turbuhaler  
    d. Twisthaler

14. Which of the following dry powder inhaler devices has more than one medication formulated in the device?
    a. Ellipta  
    b. Flexhaler  
    c. HandiHaler  
    d. Twisthaler

15. Which of the following dry powder inhaler devices is ready for use as soon as the cap is removed?
    a. Flexhaler  
    b. Pressair  
    c. Respimat  
    d. Twisthaler

16. Counsel patients to discard the Ellipta device:
    a. Four weeks after the date it was opened  
    b. Six weeks after the date it was opened  
    c. Eight weeks after the date it was opened  
    d. On the date provided by the manufacturer on the box

17. Counsel patients to discard the combination fluticasone and salmeterol Diskus:
    a. Four weeks after removal from the foil pouch  
    b. Six weeks after removal from the foil pouch  
    c. Eight weeks after removal from the foil pouch  
    d. On the date provided by the manufacturer on the box

18. Medications formulated in the Diskus differ from those formulated in the Ellipta in which of the following?
    a. Dosing frequency  
    b. Cleaning and storage  
    c. Inclusion of a dose counter  
    d. Formulation as single and combination products

19. Which of the following acronyms describes the correct use of the Respimat device?
    a. POP: Press, open, prime  
    b. POP: Prime, open, place  
    c. TOP: Turn, open, press  
    d. TOP: Turn, open, prime

20. Which of the following is not a limitation associated with nebulizer use in pediatric patients?
    a. Cost  
    b. Portability  
    c. Administration time  
    d. Little need for coordination
References


7. Atrovvent HFA (ipratropium) prescribing information. Ridgefield, CT; Boehringer Ingelheim Pharmaceuticals, Inc.; 2012.


15. Symbicort (budesonide/formoterol) prescribing information. Wilmington, DE; AstraZeneca LP; 2012.


17. Dulera (mometasone and formoterol) prescribing information. Whitehouse Station, NJ; Merck Sharp & Dohme Corp.; 2010.

18. Combivent Inhalation Aerosol (ipratropium bromide and albuterol sulfate) prescribing information. Ridgefield, CT; Boehringer Ingelheim Pharmaceuticals, Inc.; 2012.


32. Spiriva HandiHaler (tiotropium) prescribing information. Ridgefield, CT; Boehringer Ingelheim Pharmaceuticals, Inc.; 2014.

33. Symbicort Respules (budesonide, formoterol) prescribing information. Ridgefield, CT; Boehringer Ingelheim Pharmaceuticals, Inc.; 2014.

34. Spiriva Respimat (tiotropium) prescribing information. Ridgfield, CT; Boehringer Ingelheim Pharmaceuticals, Inc.; 2014.


40. Amzturn Ellipta (fluticasone furoate) prescribing information. Research Triangle Park, NC; GlaxoSmithKline; 2014.

41. Alvesco (ciclesonide) prescribing information. Research Triangle Park, NC; GlaxoSmithKline; 2014.

42. ProAir RespiClick (albuterol) prescribing information. Horsham, PA: Teva Respiratory, LLC; 2015.


44. Combivent Respimat (ipratropium bromide and albuterol) prescribing information. Ridgefield, CT; Boehringer Ingelheim Pharmaceuticals, Inc.; 2014.

45. Strendri Respimat (olodaterol) prescribing information. Ridgefield, CT; Boehringer Ingelheim Pharmaceuticals, Inc.; 2014.

46. Spiriva Respimat (tiotropium) prescribing information. Ridgfield, CT; Boehringer Ingelheim Pharmaceuticals, Inc.; 2014.


