

Asthma and chronic obstructive pulmonary disease inhalers: Techniques for proper use

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ABSTRACT

Background: Asthma and chronic obstructive pulmonary disease (COPD) affect millions of Americans. Inhalers are necessary to manage these diseases, but physicians and patients often struggle to use them correctly.

Objective: To simplify inhaler use for patients and physicians.

Methods: This article compares the various inhalers used to treat asthma and COPD, their techniques for use, and the steps necessary to prime the inhaler if required. The authors provide a suggested standardized technique for the use of metered-dose inhalers, dry powder inhalers, and soft-mist inhalers to provide for a more universal approach for the use of these medications and summarizes how each product is to be used per the U.S. Food and Drug Administration approved package insert.

Results and Conclusions: The simplified techniques proposed in this article for the use of metered-dose inhalers, dry powder inhalers, and soft mist inhalers used to treat asthma and COPD may limit inhaler misuse and aid in proper medication delivery and treatment.

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Asthma is a heterogeneous disease associated with variable airway obstruction caused by inflammation and airway hyperresponsiveness. Symptoms typically manifest as wheezing, chest tightness, shortness of breath, and cough.¹ The Centers for Disease Control and Prevention estimates that 22.6 million Americans have asthma, and the estimated total cost of asthma was \$56 billion in 2007.^{2,3} Chronic obstructive pulmonary disease (COPD) is characterized by obstructive airflow limitation that is irreversible and usually progressive. The American Lung Association estimates that 12.7 million Americans have COPD, and the estimated total cost of COPD was \$50 billion in 2010.⁴ These statistics emphasize the burden of these diseases and highlight the importance of their management.

Inhaled pharmacologic agents are necessary for most patients to properly manage asthma and COPD. These medications are divided into those used for rescue or quick relief and for maintenance or long-term control.^{1,5} Short-acting β_2 -agonists (SABAs) are first-line

rescue medications for acute asthma due to their ability to rapidly reverse bronchoconstriction.^{1,6} Short-acting anticholinergic agents are used in COPD and may be used for rescue in asthma when SABAs are not tolerated.¹ The most commonly used maintenance medications are inhaled corticosteroids (ICS), used alone or in combination with long-acting β_2 -agonists (LABAs) or long-acting anticholinergics. These medications work by reducing airway inflammation and controlling bronchoconstriction.^{7,8} A black-box warning exists for the use of LABA monotherapy in asthma due to an increased risk of asthma-related deaths in adults and asthma-related hospitalizations in children and adolescents. Thus, LABAs are only used in combination with ICS in the treatment of asthma.⁹ This warning does not exist for COPD. Combination ICS and LABA inhalers may be approved for use in asthma alone or both asthma and COPD. Combination ICS and long-acting anticholinergic inhalers are only approved for use in COPD.

Inhaled pharmacologic agents are the mainstays for asthma and COPD therapy due to their limited adverse effect profiles.⁸ Metered-dose inhalers (MDI) and dry powder inhalers (DPI) are the most frequently used delivery devices. The soft mist inhaler (SMI) is a relatively new type of delivery device. As of December 2015, there are four SMIs commercially available in the United States, all marketed under the trade name, Respimat (Boehringer Ingelheim Pharmaceuticals, Inc., Ridgefield, CT). Regardless of the type of inhaler used, patients only achieve maximal clinical benefit if they use these inhalers correctly.

In the real world, patients and physicians often struggle with mastering the appropriate inhalation

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techniques. Errors in inhalation technique and medication delivery occur in 20–80% of those who use them.^{10–12} Studies of physicians consistently yield similar results. Only 10 to 52% of physicians demonstrate adequate knowledge of proper inhaler use.^{12–17} The increasing complexity and variety of inhalers have only amplified problems associated with their use.⁸ Patients also have difficulty keeping track of expiration dates and the amount of medication that remains in inhalers without dose counters. In a survey of adults and parents of children with asthma, 50.6% of rescue inhalers were found to be expired and 48.2% were found to be empty when needed for quick symptom relief.¹⁸ Another layer of complexity is added when a physician prescribes one inhaler but the patient's insurance company suggests another.

In this article, we compare the various inhalers used to treat asthma and COPD in the United States, techniques for their use, and the steps necessary to prime the inhaler if required. The authors provide a suggested standardized technique for the use of MDIs, DPIs, and SMIs to provide for a more universal approach for the use of these medications. The Allergy and Asthma Network publishes an excellent summary of most inhalers, with pictures and instructions that can be accessed from their Web site.¹⁹ The proposed techniques in this article may improve medication delivery and reduce confusion for most patients for these three types of inhalers.

MDIs

MDIs contain therapeutically active ingredients dissolved or suspended in a propellant or mixture of propellants, and are used to deliver a variety of asthma and COPD medications, including SABAs, short-acting anticholinergics, ICS, and combination medications.²⁰ These inhalers require priming to ensure that the appropriate amount of medication is released, and most require shaking. The specific priming processes are included in Table 1. All MDIs require cleaning of the mouthpiece at least once weekly (except Aerospin; Meda Pharmaceuticals Inc., Somerset, NJ). MDIs are similar in product design, shape, and instructions for use. The following technique is proposed as a standard technique for the use of MDIs.^{21–23} Major differences are noted elsewhere in the text.

First, stand or sit up straight with the head tilted back slightly. Prime and, if needed, shake the inhaler as instructed in the package insert or presented in Table 1. Then, comfortably exhale to the end of a normal breath or end-tidal volume. Close the lips around the inhaler mouthpiece or position the mouthpiece approximately two finger widths in front of an open mouth. The inhaler should be in the upright or correct position. Next, begin to inhale slowly and deeply through the

mouth over ~5–6 seconds. After ~1.5 to 2 seconds, dispense the medication (by pressing down on the inhaler canister) while continuing to breathe in and taking in a full inhalation. Remove the inhaler from the mouth and hold the breath for as long as possible, up to 10 seconds, with a closed mouth, then exhale gently. Shake the inhaler, if needed, between repeated doses.

Spacers are devices that attach to MDIs. In patients who struggle to master the proper technique for the use of MDIs, particularly pediatric patients, these devices can minimize coordination difficulties and aid in medication delivery to the lungs rather than the oropharynx. Spacers may include one-way valves to further enhance medication delivery and can be combined with masks for use by young children. These devices require regular cleaning.²⁴ All MDIs can be used with a spacer (with the exception of Aerospin, which already has a spacer device built into the inhaler). The technique for using a MDI with a spacer is similar to the technique already mentioned, with a few notable differences. After priming and shaking the inhaler, place it into the spacer and exhale as mentioned. Place the spacer mouthpiece into the mouth and close the lips around it. Inhale and dispense the medication as instructed above. Remove the inhaler with spacer from the mouth. Hold the breath and exhale as mentioned. The Centers for Disease Control and Prevention Web site has excellent illustrations and videos, in both English and Spanish, for how to use a MDI with and without a spacer.²³ These illustrations are shown in Figs. 1–3.

SABAs

1. ProAir HFA (hydrofluoroalkane) (albuterol sulfate, 90 μ g; Teva Respiratory, LLC, Horsham, PA)²⁵
2. Proventil HFA (albuterol sulfate, 90 μ g; Merck & Co., Inc., Whitehouse Station, NJ)²⁶
3. Ventolin HFA (albuterol sulfate, 90 μ g; Glaxo-SmithKline, Research Triangle Park, NC)²⁷
4. Xopenex HFA (levalbuterol tartrate, 45 μ g; Sunovion Pharmaceuticals Inc., Marlborough, MA)²⁸

Of note, unlike the other SABAs, Xopenex HFA is not approved by the U.S. Food and Drug Administration for use in the prevention of exercise-induced bronchospasm.

Short-Acting Anticholinergic

1. Atrovent HFA (ipratropium bromide, 17 μ g; Boehringer Ingelheim)²⁹

Although Atrovent HFA is only approved by the U.S. Food and Drug Administration for use in COPD, it is used to treat asthma in an off-label fashion, particularly when SABAs are not tolerated or as an add-on medication.¹

Table 1 MDIs priming instructions

Brand Name	Inhaler Type	Active Ingredient	Class	Shaking Required Before Each Use	Priming Instructions (before first use)	Time After Which Repeated Priming Is Needed (if not used)
ProAir HFA	MDI	Albuterol sulfate	SABA	Yes	3 sprays, shaking well before each spray	>2 wk
Proventil HFA	MDI	Albuterol sulfate	SABA	Yes	4 sprays, shaking well before each spray	>2 wk
Ventolin HFA	MDI	Albuterol sulfate	SABA	Yes	4 sprays, shaking well before each spray	>2 wk or if dropped
Xopenex HFA	MDI	Levalbuterol tartrate	SABA	Yes	4 sprays, shaking well before each spray	>3 days
Atrovent HFA	MDI	Ipratropium bromide	Short-acting anticholinergic	No	2 sprays	>3 days
Aerospan	MDI	Flunisolide	ICS	Yes	2 sprays	>2 wk
Alvesco	MDI	Ciclesonide	ICS	No	3 sprays	>10 days
Asmanex HFA	MDI	Mometasone furoate	ICS	Yes	4 sprays, shaking well before each spray	>5 days
Flovent HFA	MDI	Fluticasone propionate	ICS	Yes	4 sprays, shaking well before each spray 1 spray only	N/A >7 days or if dropped
Qvar HFA	MDI	Beclomethasone dipropionate	ICS	No	2 sprays	>10 days
Advair HFA	MDI	Fluticasone propionate + salmeterol xinafoate	ICS + LABA	Yes	4 sprays, shaking well before each spray	>4 wk or if dropped
Dulera	MDI	Mometasone furoate + formoterol fumarate dihydrate	ICS + LABA	Yes	4 sprays, shaking well before each spray	>5 days
Symbicort	MDI	Budesonide + formoterol fumarate dihydrate	ICS + LABA	Yes	2 sprays, shaking well before each spray	>7 days or if dropped

MDI = Metered-dose inhaler; HFA = hydrofluoroalkane; SABA = short-acting β_2 -agonist; ICS = inhaled corticosteroid; N/A = not applicable; LABA = long-acting β_2 -agonist.

ICS

1. Aerospan (flunisolide, 80 μg ; Meda Pharmaceuticals)³⁰

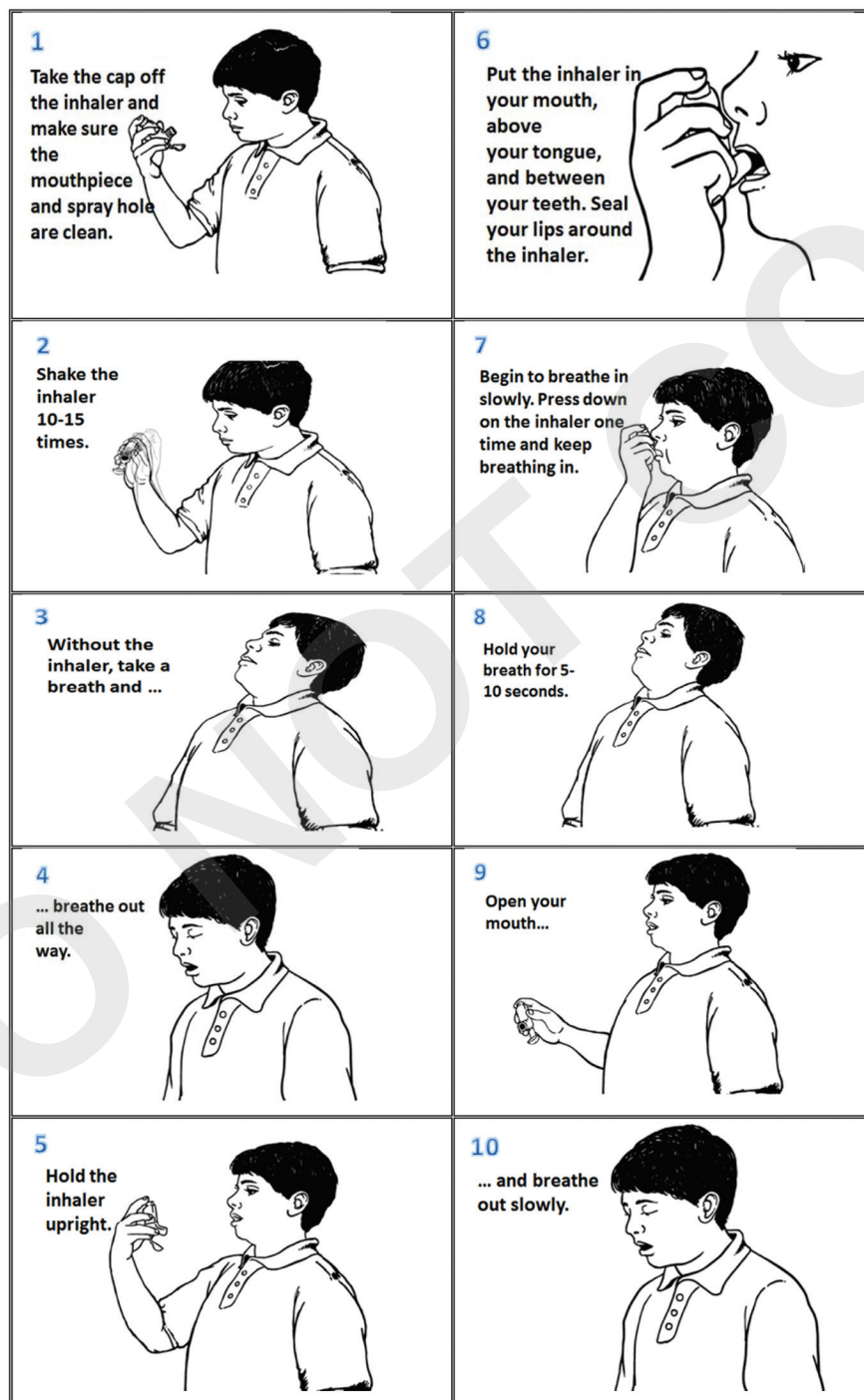
To prepare Aerospan for use, pull the built-in purple actuator out from the gray spacer forming an "L" shape.

2. Alvesco (ciclesonide, 80 μg , 160 μg ; Sunovion Pharmaceuticals)³¹

Ciclesonide is a unique medication in that it has a small particle size and is a prodrug. Ciclesonide is converted into C21-desisobutyl-*ciclesonide* (des-ciclesonide), the active metabolite, once inhaled into

Know How to Use Your Asthma Inhaler

Using a metered dose inhaler (inhaler in mouth)



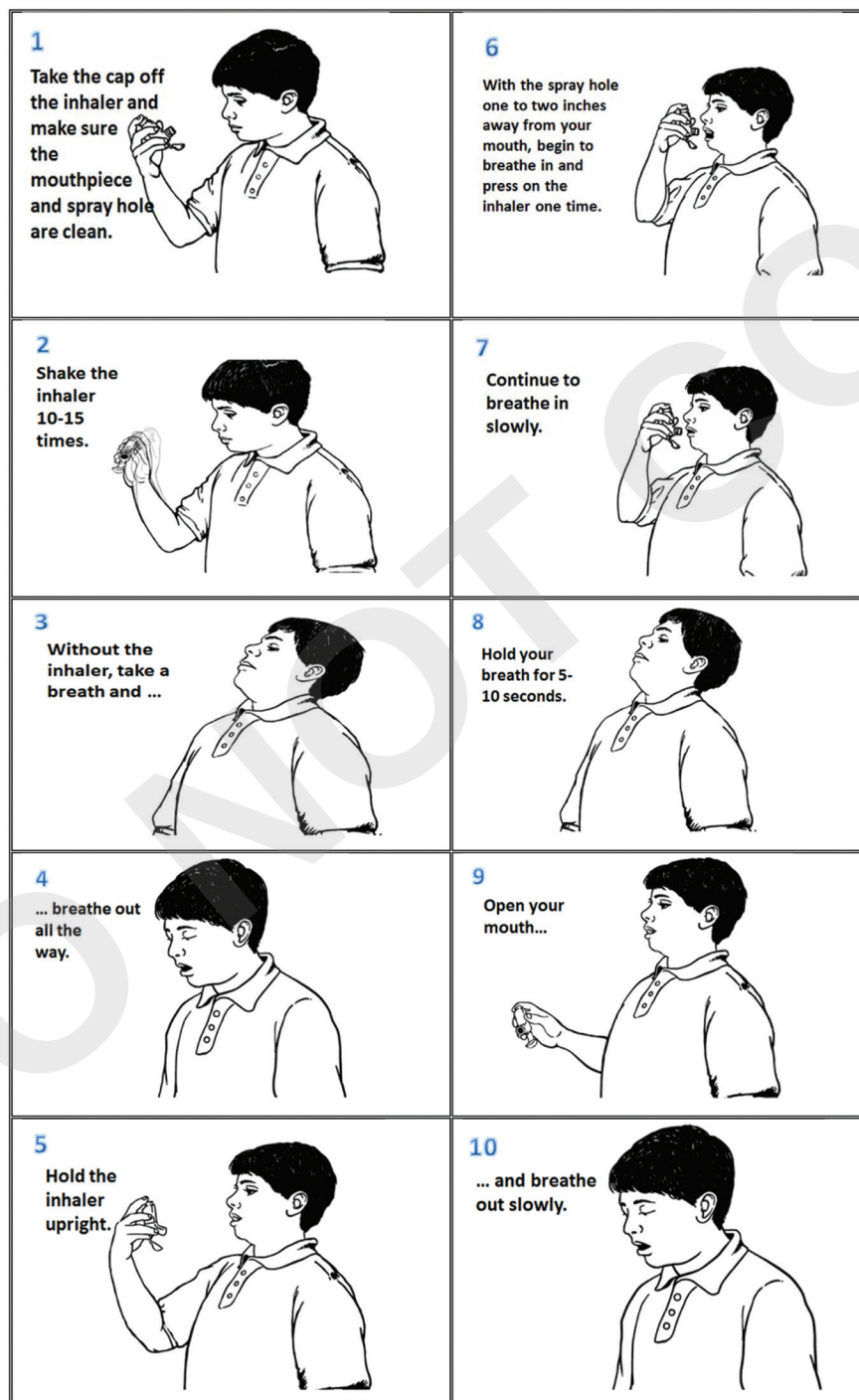
National Center for Environmental Health
Division of Environmental Hazards and Health Effects



Figure 1. Illustration for how to use a metered-dose inhaler (MDI) with lips closed around the mouthpiece. Obtained from the Centers for Disease Control and Prevention web site (see Ref. 23).

Know How to Use Your Asthma Inhaler

Using a metered dose inhaler one to two inches from mouth



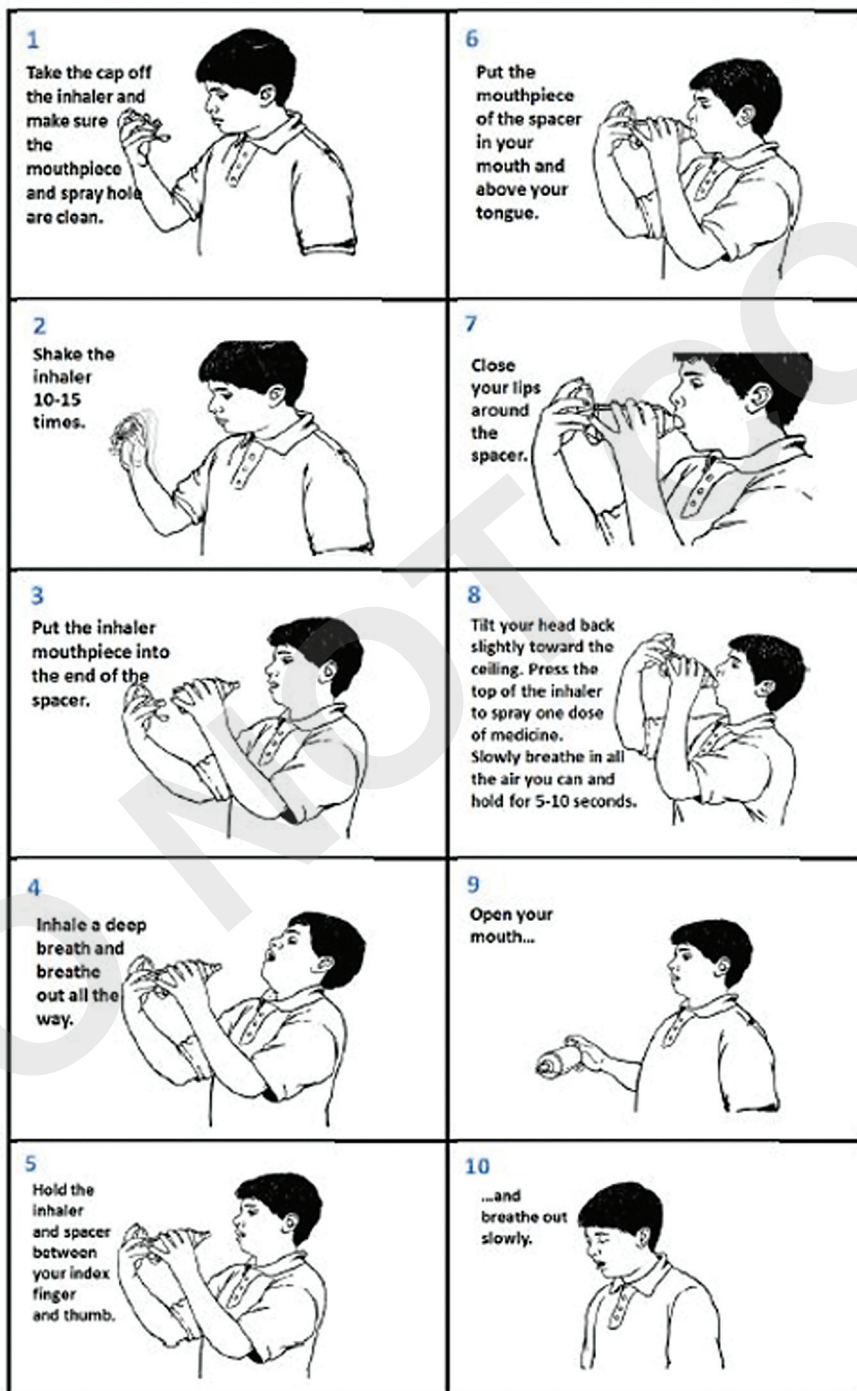
National Center for Environmental Health
Division of Environmental Hazards and Health Effects



Figure 2. Illustration for how to use a metered-dose inhaler (MDI) with an open mouth. Obtained from the Centers for Disease Control and Prevention web site (see Ref. 23).

Know How to Use Your Asthma Inhaler

Using a metered dose inhaler with a spacer



National Center for Environmental Health
Division of Environmental Hazards and Health Effects



Figure 3. Illustration for how to use a metered-dose inhaler (MDI) with a spacer. Obtained from the Centers for Disease Control and Prevention web site (see Ref. 23).

Table 2 DPIs priming instructions

Brand Name	Inhaler Type	Active Ingredient	Class	Shaking Required Before Each Use	Priming Instructions (before first use)	Time After Which Repeated Priming Is Needed (if not used)
ProAir RespiClick	DPI	Albuterol sulfate	SABA	No	None	N/A
Arnuity Ellipta	DPI	Fluticasone furoate	ICS	No	None	N/A
Asmanex Twisthaler	DPI	Mometasone furoate	ICS	No	None	N/A
Flovent Diskus	DPI	Fluticasone propionate	ICS	No	None	N/A
Pulmicort Flexhaler	DPI	Budesonide	ICS	No	2 complete twists of the base	N/A
Arcapta Neohaler	DPI	Indacaterol maleate	LABA	No	None	N/A
Foradil Aerolizer	DPI	Formoterol fumarate	LABA	No	None	N/A
Serevent Diskus	DPI	Salmeterol xinafoate	LABA	No	None	N/A
Incruse Ellipta	DPI	Umeclidinium	Long-acting anticholinergic	No	None	N/A
Spiriva HandiHaler	DPI	Tiotropium bromide	Long-acting anticholinergic	No	None	N/A
Tudorza Pressair	DPI	Aclidinium bromide	Long-acting anticholinergic	No	None	N/A
Advair Diskus	DPI	Fluticasone propionate + salmeterol xinafoate	ICS + LABA	No	None	N/A
Breo Ellipta	DPI	Fluticasone furoate + vilanterol trifenate	ICS + LABA	No	None	N/A
Anoro Ellipta	DPI	Umeclidinium + vilanterol	ICS + long-acting anticholinergic	No	None	N/A

DPI = Dry powder inhaler; SABA = short-acting β_2 -agonist; N/A = not applicable; ICS = inhaled corticosteroid; LABA = long-acting β_2 -agonist.

the airways. Des-ciclesonide has an affinity for glucocorticoid receptors that is 100 times greater than the parent compound, although the clinical significance is unknown.³²

3. Asmanex HFA (mometasone furoate 100 μg , 200 μg ; Merck & Co.)³³

4. Flovent HFA (fluticasone propionate 44 μg , 110 μg , 220 μg ; GlaxoSmithKline)³⁴

5. Qvar HFA (beclomethasone dipropionate 40 μg , 80 μg ; Teva Respiratory)³⁵

ICS Plus LABAs

1. Advair HFA (fluticasone propionate/salmeterol xinafoate, 45 μg /21 μg , 115 μg /21 μg , 230 μg /21 μg ; GlaxoSmithKline)³⁶

2. Dulera (mometasone furoate/formoterol fumarate dihydrate 100 μg /5 μg , 200 μg /5 μg ; 3M Health Care Ltd., Loughborough, United Kingdom)³⁷

3. Symbicort (budesonide/formoterol fumarate dihydrate, 80 μg /4.5 μg , 160 μg /4.5 μg ; AstraZeneca Pharmaceuticals LP, Wilmington, DE)³⁸

DPIs

DPIs disperse particles into the respiratory tract during inspiration and are used to deliver SABAs, ICS, LABAs, and combination medications.²⁰ These inhalers do not require priming or shaking (with the exception of Pulmicort Flexhaler, AstraZeneca Pharmaceuticals, which requires two twists of the base before use). The specific priming processes are included in Table 2. These inhalers should be cleaned as needed (with the exception of Pulmicort Flexhaler, which requires the mouthpiece to be cleaned weekly). DPIs vary widely in product design and typically contain either a medication that should be inserted into the inhaler or an inhaler with the medication already contained therein. Preparing the inhaler for use and medication delivery differs for each device. In general, this is accomplished by either puncturing or crushing the medication or by twisting part of the inhaler. The following technique is proposed as a standardized technique for the use of DPIs.³⁹ Major differences are noted elsewhere in the text.

As with the MDIs, stand or sit up straight with the head tilted back slightly. Prime the inhaler, and prepare the device for use as instructed in the package insert or in Table 2. Comfortably exhale to the end of a normal breath or end-tidal volume and then close the lips around the inhaler mouthpiece. The inhaler should be in the upright or correct position. Next, inhale quickly and deeply through the mouth, and taking in a full inhalation. Remove the inhaler from the mouth and hold the breath for as long as possible, up to 10 seconds, with a closed mouth. Then exhale slowly and gently. No waiting is needed between repeated doses. Spacers are not used with DPIs.

SABA

1. ProAir RespiClick (albuterol sulfate, 90 μg ; Teva Respiratory) contains lactose monohydrate as an inactive ingredient and should be used with caution in patients with a severe allergy to milk proteins⁴⁰

To prepare ProAir RespiClick for use, place the inhaler in the upright position and open the red cap until it clicks. Opening the cap loads the inhaler with a dose of medication. The patient must be careful not to obstruct the air vent while inhaling. After use, the cap must be closed.

ICS

1. Arnuity Ellipta (fluticasone furoate 100 μg , 200 μg ; GlaxoSmithKline) contains lactose monohydrate as an inactive ingredient and should be used with caution in patients with a severe allergy to milk proteins⁴¹

To prepare Arnuity Ellipta for use, open the cover by sliding it down until it clicks. This pierces the foil blister and releases the medication. Do not obstruct the air vent while inhaling. This preparation technique applies to all Ellipta inhalers.

2. Asmanex Twisthaler (mometasone furoate 110 μg , 220 μg ; Merck & Co.)⁴²

To prepare the Asmanex Twisthaler for use, place it in the upright position and twist off the cap by using a counterclockwise motion. Removing the cap in this fashion loads the inhaler with a dose of medication. The inhaler is pointed toward the back of the throat for use. After use, the cap is placed back on the inhaler by using a clockwise motion while gently pressing down. The device will click, which indicates proper closure. This process must be repeated to load a second dose.

3. Flovent Diskus (fluticasone propionate 50 μg , 100 μg , 250 μg ; GlaxoSmithKline) contains lactose monohydrate as an inactive ingredient and should be used with caution in patients with a severe allergy to milk proteins⁴³

To prepare the Flovent Diskus for use, it is held in a level, flat position in the left hand. The thumb of the right hand is placed on the thumb grip, which is

pushed until the mouthpiece snaps into place, then the lever is slid until it clicks. After use, the thumb grip is pushed back into place, which covers the mouthpiece and closes the device.

4. Pulmicort Flexhaler (budesonide, 90 μg , 180 μg ; AstraZeneca)⁴⁴

To prepare the Pulmicort Flexhaler for use, the inhaler is held upright with the colored base at the bottom, and the cap is removed. The colored base is twisted as far as it will go in one direction and then fully back in the other direction until it stops while not covering the mouthpiece. This twisting action loads a dose of medication into the inhaler. The cover is placed back onto the inhaler and it is twisted shut to close the inhaler.

LABA

1. Arcapta Neohaler (indacaterol maleate, 75 μg ; Novartis Pharmaceuticals Corporation, East Hanover, NJ)⁴⁵

To prepare the Arcapta Neohaler for use, insert a blister capsule into the capsule chamber, close the inhaler, and press the two piercing buttons to release the medication.

2. Foradil Aerolizer (formoterol fumarate, 12 μg ; Merck & Co.)⁴⁶

The Foradil Aerolizer must be kept upright, and a twisting motion is used to open and close it. To prepare the inhaler for use, insert a blister capsule into the chamber of the inhaler, then close the inhaler and press the two piercing buttons to release the medication.

3. Serevent Diskus (salmeterol xinafoate, 50 μg ; GlaxoSmithKline)⁴⁷

To prepare the Serevent Diskus for use, it is held in a level, flat position in the left hand. The thumb of the right hand is placed on the thumb grip, which is pushed until the mouthpiece snaps into place, then the lever is slid until it clicks. After use, the thumb grip is pushed back into place, which covers the mouthpiece and closes the device.

Long-Acting Anticholinergics

1. Incruse Ellipta (umeclidinium, 62.5 μg ; GlaxoSmithKline) contains lactose monohydrate as an inactive ingredient and should be used with caution in patients with a severe allergy to milk proteins⁴⁸

2. Spiriva HandiHaler (tiotropium bromide, 18 μg ; Boehringer Ingelheim)⁴⁹

To prepare the Spiriva HandiHaler for use, first open the “dust cap” by pressing the green piercing button. The inhaler must be upright for use. Then open the mouthpiece and insert a blister capsule into the capsule chamber. Close the mouthpiece and then press the green piercing button to release the medication. While keeping

Table 3 SMIs priming instructions

Brand Name	Inhaler Type	Active Ingredient	Class	Shaking Required Before Each Use	Priming Instructions (before first use)	Time After Which Repeated Priming Is Needed (if not used)
Combivent Respimat	SMI	Ipratropium bromide and albuterol sulfate	Short-acting anticholinergic + SABA	No	4 sprays, once spray becomes visible 1 spray only	>21 days >3 days but ≤21 days
Striverdi Respimat	SMI	Olodaterol hydrochloride	LABA	No	4 sprays, once spray becomes visible 1 spray only	>21 days >3 days but ≤21 days
Spiriva Respimat	SMI	Tiotropium bromide	Long-acting anticholinergic	No	4 sprays, once spray becomes visible 1 spray only	>21 days >3 days but ≤21 days
Stiolto Respimat	SMI	Tiotropium bromide and olodaterol	ICS + long-acting anticholinergic	No	4 sprays, once spray becomes visible 1 spray only	>21 days >3 days but ≤21 days

SMI = Soft mist inhaler; SABA = short-acting β_2 -agonist; LABA = long-acting β_2 -agonist; ICS = inhaled corticosteroid.

the same capsule in the device, the user should complete another inhalation to receive the full dose.

3. Tudorza Pressair (aclidinium bromide, 400 μg ; AstraZeneca)⁵⁰

The Tudorza Pressair must be held in the correct position for use, with the green button facing upward. To prepare the inhaler for use, press and release the green button on the device to dispense the medication, which changes the “control window” from red to green. Once the medication has been inhaled, this window changes back to red to indicate that the full dose was correctly delivered.

ICS Plus LABAs

1. Advair Diskus (fluticasone propionate/salmeterol xinafoate, 100 μg /50 μg , 250 μg /50 μg , 500 μg /50 μg ; GlaxoSmithKline, Research Triangle Park, NC)⁵¹

To prepare the Advair Diskus for use, it is held in a level, flat position in the left hand. The thumb of the right hand is placed on the thumb grip, which is pushed until the mouthpiece snaps into place, then the lever is slid until it clicks. After use, the thumb grip is pushed back into place, which covers the mouthpiece and closes the device.

2. Breo Ellipta (fluticasone furoate/vilanterol trifenate 100 μg /25 μg , 200 μg /25 μg ; GlaxoSmithKline)

contains lactose monohydrate as an inactive ingredient and should be used with caution in patients with a severe allergy to milk proteins⁵²

ICS Plus Long-Acting Anticholinergic

1. Anoro Ellipta (umeclidinium/vilanterol, 62.5 μg /25 μg ; GlaxoSmithKline) contains lactose monohydrate as an inactive ingredient and should be used with caution in patients with a severe allergy to milk proteins⁵³

SMIs

SMIs contain propellant-free liquid formulations that are inhaled as a slow-moving aerosol mist through a nozzle system and deliver LABAs, long-acting anticholinergics, and combination medications.⁵⁴ These inhalers are all available under the trade name, Respimat and, therefore, have the same priming processes and instructions for use. The specific priming process is included in Table 3. These inhalers require cleaning of the mouthpiece at least once weekly. The following technique is proposed as a standardized technique for the use of SMIs.^{54–57} Major differences are noted.

As with the MDIs and DPIs, stand or sit up straight with the head tilted back slightly. Prime the inhaler as

instructed in the package insert or as mentioned in Table 3. To prepare the inhaler for use, while holding the inhaler upright, turn the base in the direction of the arrows until it clicks. Open the cap, exhale fully through the mouth and then close the lips around the mouthpiece. The inhaler is pointed toward the back of the oropharynx. Next, while inhaling slowly and deeply through the mouth, immediately press the dose release button to administer the medication and continue to take in a full inhalation. Remove the inhaler from the mouth and hold the breath for as long as possible, up to 10 seconds, with a closed mouth. Then exhale gently. No waiting is needed between repeated doses. Spacers are not used with SMIs.

SABA Plus Short-Acting Anticholinergic

1. Combivent Respimat (ipratropium bromide/albuterol sulfate, 20 µg/100 µg; Boehringer Ingelheim)⁵⁵

Combivent Respimat is used by opening the cap and pressing the dose release button to release the medication. The cap color is orange. This preparation technique applies to all Respimat inhalers. Combivent was previously available as a MDI, but this device was discontinued in the United States in 2013.

LABA

1. Striverdi Respimat (olodaterol hydrochloride, 2.5 µg; Boehringer Ingelheim)⁵⁷

The cap color is yellow.

Long-Acting Anticholinergic

1. Spiriva Respimat (tiotropium bromide, 1.25 µg, 2.5 µg; Boehringer Ingelheim)⁵⁴

The cap color is aqua. This medication is approved for use in both COPD and asthma.

ICS Plus Long-Acting Anticholinergic

1. Stiolto Respimat (tiotropium bromide/olodaterol, 2.5 µg/2.5 µg; Boehringer Ingelheim)⁵⁶

The cap color is green.

DISCUSSION

Knowledge of inhaler technique is imperative for effective medication delivery in the treatment of asthma and COPD. Given the assortment of different inhalers available, each with lengthy and detailed instructions, patients and physicians often struggle to use them correctly. In a study of 1664 patients, the majority of the errors were failure to exhale before actuation, too forceful an inhalation, inadequate breath-holding after inhalation, and not shaking the inhaler. In this study, instruction by a health care professional was the only modifiable risk factor associated with reduced inhaler misuse.⁷ It is imperative for physicians, other health care professionals, and patients to master correct inhaler techniques.

Although inhalers vary significantly in product design and shape, the three main types of inhalers have similar techniques for use. The standardized and simplified techniques proposed in this article for the use of MDIs, DPIs, and SMIs used to treat asthma and COPD may limit inhaler misuse and aid in proper medication delivery and treatment. These techniques should not be taken as a replacement for the U.S. Food and Drug Administration package insert but as a universal technique that will, it is hoped, improve medication delivery and reduce confusion for most patients.

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