

Respiratory Conditions and Inhaler Therapy

Clinical Pharmacy Service Line

Henry Ford Health System

January 2022

Objectives

1. Describe classes of inhalers used for respiratory conditions such as COPD and Asthma
2. Educate patients on appropriate inhaler therapy
3. Identify barriers to optimizing inhaler therapy

Types of Inhalers: Controllers vs. Rescue

Controllers or maintenance inhaler therapy

- Control your disease state even when feeling “fine”
- Need to be used every day as prescribed to help control disease state and prevent exacerbations
- Typically long-acting inhalers used once or twice daily

Rescue inhalers

- Used when feeling short of breath or for wheezing
- Fast onset of action
- Short acting
- Only used when needed (“PRN”)



SHORT-ACTING BETA₂-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours

<p>ProAir[®] Digihaler[™] 117 mcg albuterol sulfate ⓂⓄ Ⓜ</p>	<p>ProAir[®] HFA 180 mcg albuterol sulfate ⓂⓄ Ⓜ</p>	<p>ProAir[®] RespiClick[™] 117 mcg albuterol sulfate ⓂⓄ Ⓜ</p>	<p>Proventil[®] HFA 108 mcg albuterol sulfate ⓂⓄ Ⓜ</p>	<p>Ventolin[®] HFA 90 mcg albuterol sulfate ⓂⓄ Ⓜ</p>	<p>Xopenex[®] HFA[®] 55 mcg levalbuterol tartrate ⓂⓄ Ⓜ</p>
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LONG-ACTING BETA₂-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer lasting relief of symptoms such as coughing, wheezing and shortness of breath for at least 12 hours

<p>Serevent[®] Diskus[™] 50 mcg salmeterol xinafoate ⓂⓄ ⓂⓄ Ⓜ</p>	<p>Striverdi[®] Respimat[™] 2.5 mcg olodaterol ⓂⓄ Ⓞ</p>
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INHALED CORTICOSTEROIDS

reduce and prevent swelling of airway tissue; they do not relieve sudden symptoms of coughing, wheezing or shortness of breath

<p>Alvesco[®] HFA 84, 160 mcg ciclesonide ⓂⓄ Ⓜ</p>	<p>ArmonAir[®] Digihaler[™] 55, 113, 232 mcg fluticasone propionate ⓂⓄ Ⓜ</p>	<p>ArmonAir[®] RespiClick[™] 55, 113, 232 mcg fluticasone propionate ⓂⓄ Ⓜ</p>	<p>Asnuity[®] Ellipta[™] 50, 100, 200 mcg fluticasone furoate ⓂⓄ Ⓜ</p>	<p>Asmanex[®] HFA 130, 260 mcg mometasone furoate ⓂⓄ Ⓜ</p>	<p>Asmanex[®] Twisthaler[™] 130, 260 mcg mometasone furoate ⓂⓄ Ⓜ</p>	<p>Flovent[®] Diskus[™] 90, 180, 270 mcg fluticasone propionate ⓂⓄ Ⓜ</p>	<p>Flovent[®] HFA 90, 180 mcg fluticasone propionate ⓂⓄ Ⓜ</p>	<p>Pulmicort[®] Flexhaler[™] 90, 180 mcg budesonide ⓂⓄ Ⓜ</p>	<p>QVAR[®] Redihaler[™] 48, 96 mcg beclomethasone dipropionate ⓂⓄ Ⓜ</p>
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COMBINATION MEDICATIONS

contain both inhaled corticosteroid and long-acting beta₂-agonist (LABA)

<p>Advair[®] Diskus[™] 100/50, 250/50, 500/50 mcg fluticasone propionate and salmeterol ⓂⓄ ⓂⓄ ⓂⓄ Ⓜ</p>	<p>Advair[®] HFA 45/21, 115/21, 230/21 mcg fluticasone propionate and salmeterol ⓂⓄ ⓂⓄ Ⓜ</p>	<p>AirDuo[®] Digihaler[™] 55/14, 113/14, 232/14 mcg fluticasone propionate and salmeterol ⓂⓄ Ⓜ</p>	<p>AirDuo[®] RespiClick[™] 55/14, 113/14, 232/14 mcg fluticasone propionate and salmeterol ⓂⓄ Ⓜ</p>	<p>Breo[®] Ellipta[™] 100/25, 200/25 mcg fluticasone furoate and vilanterol ⓂⓄ ⓂⓄ Ⓜ</p>	<p>Dulera[®] 100/5, 200/5 mcg mometasone furoate and formoterol fumarate dihydrate ⓂⓄ ⓂⓄ Ⓜ</p>	<p>Symbicort[®] 90/4.5, 180/4.5 mcg budesonide and formoterol fumarate dihydrate ⓂⓄ ⓂⓄ Ⓜ</p>	<p>Wixela[™] Inhub[™] 100/50, 250/50, 500/50 mcg fluticasone propionate and vilanterol xinafoate ⓂⓄ ⓂⓄ Ⓜ</p>	<p>Anoro[®] Ellipta[™] 60.5/25 mcg arformoterol and vilanterol ⓂⓄ Ⓞ</p>	<p>Beverpi Aerosphere[®] 54.5 mcg glycopyrronium and formoterol fumarate ⓂⓄ Ⓞ</p>	<p>Stiolto[™] Respimat[™] 2.5/2.5 mcg tiotropium bromide and olodaterol ⓂⓄ Ⓞ</p>	<p>Trelegy[®] Ellipta[™] 200/62.5/25 mcg, 100/62.5/25 mcg fluticasone furoate, vilanterol, and umeclidinium ⓂⓄ ⓂⓄ Ⓜ</p>	<p>Breath Aerosphere[®] 100/4.5 mcg budesonide, glycopyrronium, and formoterol fumarate ⓂⓄ Ⓞ</p>
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MUSCARINIC ANTAGONISTS (ANTICHOLINERGIC)

relieve cough, sputum production, wheeze and chest tightness associated with chronic lung disease

<p>Short-acting</p> <p>Atrovent[®] HFA 17 mcg ipratropium bromide ⓂⓄ Ⓞ</p>	<p>Long-acting</p> <p>Increase[®] Ellipta[™] 82.5 mcg umeclidinium inhalation powder ⓂⓄ Ⓞ</p>	<p>Spiriva[®] Handihaler[™] 18 mcg tiotropium bromide ⓂⓄ Ⓞ</p>	<p>Spiriva[®] Respimat[™] 1.8/1.5 mcg tiotropium bromide ⓂⓄ ⓂⓄ Ⓞ</p>	<p>Tadorza[™] Pressair[™] 400 mcg acetic acid formoterol ⓂⓄ Ⓞ</p>
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COMBINATION MEDICATIONS

contain muscarinic antagonist and beta₂-agonist

<p>Short-acting</p> <p>Combivent[®] Respimat[™] 32/160 mcg ipratropium bromide and albuterol ⓂⓄ Ⓞ</p>	<p>Long-acting</p> <p>Duaklir[®] Pressair[™] 400, 12 mcg acetic acid formoterol and umeclidinium fumarate dihydrate ⓂⓄ Ⓞ</p>
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BIOLOGICS

target cells and pathways that cause airway inflammation; delivered by injection or IV

<p>Cinqair[®] mepolizumab Ⓜ</p>	<p>Dupixent[®] dupilumab Ⓜ</p>	<p>Fasenra[™] benralizumab Ⓜ</p>	<p>Nucala[®] mepolizumab Ⓜ</p>	<p>Xolair[®] omalizumab Ⓜ</p>
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BRONCHIAL THERMOPLASTY

A minimally invasive procedure that uses mild heat to reduce airway smooth muscle, leading to fewer severe asthma flares, ER visits, and days lost from activities. www.cbtaasthma.com

PDE4 INHIBITORS

decrease long-term inflammation and reduce exacerbations

<p>Baliresp[®] 250, 500 mcg roflumilast Ⓜ</p>

Common Classes of Pharmacologic Respiratory Therapies

LAMA

- Long-acting muscarinic antagonists, or anticholinergic agents

LABA

- Long-acting Beta₂-agonists

ICS

- Inhaled Corticosteroids

PDE4i

- Phosphodiesterase-4-inhibitors

Common Classes of Inhalers

LAMA

Short- and Long-acting muscarinic antagonists, or anticholinergic agents (SAMA and LAMA)

- Blocks bronchoconstriction effects of acetylcholine on M3 muscarinic receptors in the airway smooth muscles

LABA

Short- and Long-acting Beta₂-agonists (SABA and LABA)

- Bronchodilator, relaxes smooth muscle airway
- Stimulates beta₂-adrenergic receptors → ↑ cyclic AMP → ↓ bronchoconstriction

ICS

Inhaled Corticosteroids (ICS)

- Inhibits airway inflammation and remodeling

Types of Devices

MDI

- Metered-dose Inhaler

DPI

- Dry-powder Inhaler

BAI

- Breath-actuated Inhaler

SMI

- Soft Mist Inhaler

Types of Devices

MDI

- Slow, steady breath
- Requires hand-breath coordination (Press canister for actuation)
- E.g. HFA



DPI

- Does not require hand-breath coordination
- Requires deep, forceful breath
- E.g. Diskus, Handihaler, Flexhaler, Ellipta



BAI

- Breath actuated, does not require hand-breath coordination
- Steady, moderate breath
- E.g. Redihaler



SMI

- Slow, steady breath
- Requires twisting to prepare dose
- E.g. Respimat



* These inhalers now include a new technology, Digihaler, see Digihaler slide for more information

COPD

- ▶ Chronic obstructive pulmonary disease (COPD): top three causes of death worldwide
- ▶ A public health challenge: treatable and preventable
- ▶ Main risk factor: tobacco smoking
 - ▶ Others include air pollution, host factors, abnormal lung development
- ▶ Characterized by:
 - ▶ Persistent respiratory symptoms (i.e., dyspnea, cough, increased sputum production) and airflow limitation
 - ▶ Spirometry required for diagnosis: Pulmonary function tests (PFTs) post-bronchodilator $FEV_1/FVC < 0.7$ (or 70%)
- ▶ Stage COPD patients A → B → C → D
 - ▶ Using: symptoms (mMRC dyspnea scale and CAT score), no. exacerbations, FEV_1

FVC: Forced vital capacity
FEV1: Forced expiratory volume in one second
mMRC: modified Medical Research Council
CAT: COPD Assessment Test

COPD Management

- ▶ Goals: ↓ symptoms, ↓ disease progression, prevent and treat exacerbations, improve quality of life, ↓ mortality

Initial Treatment		
	mMRC 0-1, CAT <10	mMRC ≥ 2, CAT ≥ 10
0 or 1 moderate exacerbations (no hospitalization)	Group A Short-acting bronchodilator (SABA, SAMA)	Group B Long-acting bronchodilator (LAMA or LABA)
>1 moderate exacerbation Or ≥ 1 hospitalization	Group C LAMA	Group D LAMA or LAMA+LABA* or ICS+LABA** *consider if highly symptomatic **consider if eosinophils ≥ 300

Asthma Management for Adults

Step 1-2

- PRN low-dose inhaled corticosteroid (ICS)-formoterol
- e.g. Symbicort PRN

Step 3

- Low-dose maintenance ICS-formoterol
- e.g. Symbicort 80 mcg 2 inhalations twice daily

Step 4

- Medium-dose maintenance ICS-formoterol
- e.g. Symbicort 160 mcg 2 inhalations twice daily

Step 5

- Add on LAMA
- Consider high-dose ICS-formoterol, etc

Metered Dose Inhalers (MDIs)



budesonide-formoterol

Symbicort



albuterol

Ventolin



Levalbuterol

Xopenex

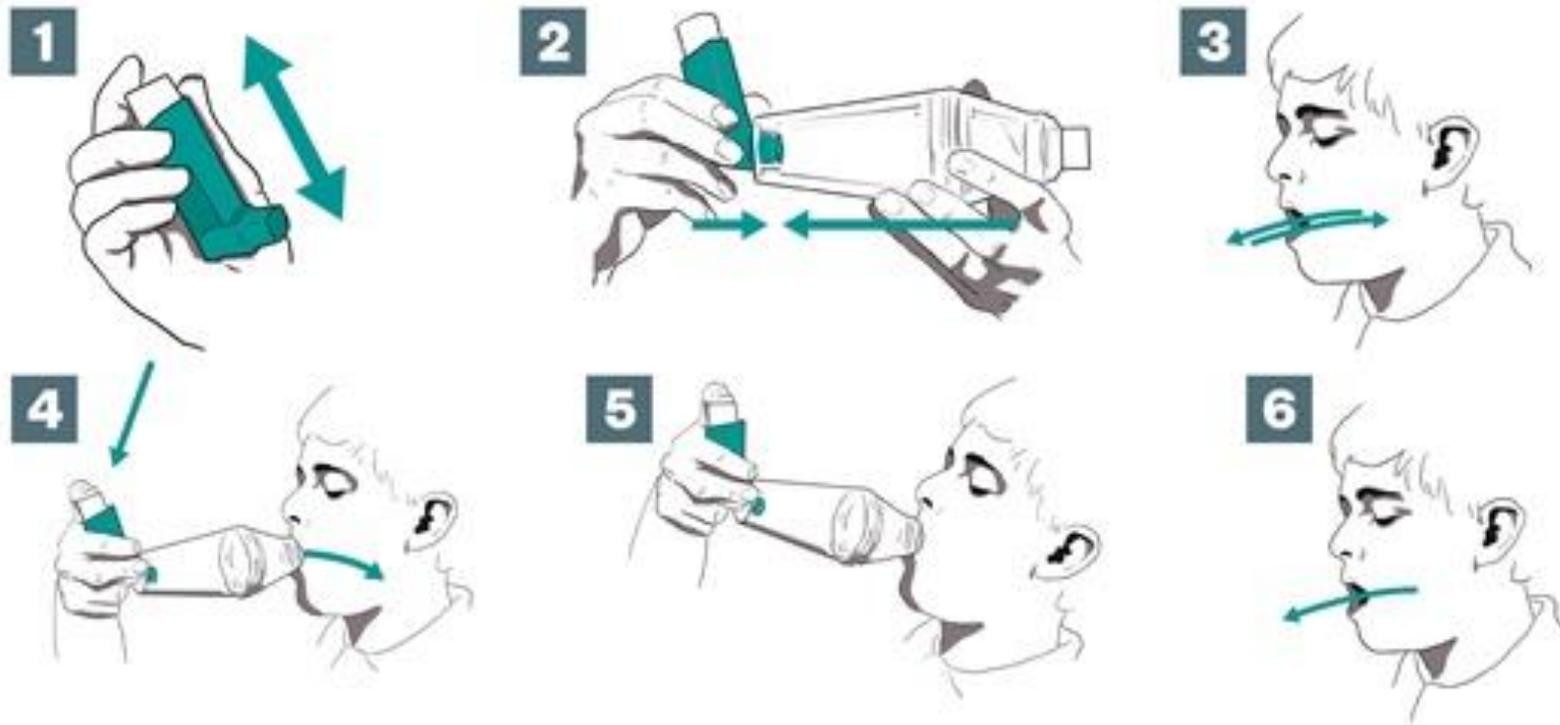
MDI: Steps for Use

1. Remove Cap
2. Hold upright and shake well
3. Breathe out gently and all the way
4. Seal lips around mouthpiece
5. Start to **slowly inhale** and **then** press firmly down on canister
6. Continue to breathe **in slowly and steadily**
7. Hold breath for 10 seconds
8. Slowly breath out
9. Wait 1 minute between doses

MDI Counseling Points

- ▶ Requires breath-actuation coordination (press the canister **after** you start to breath in)
- ▶ Breath in **slowly and steadily**
- ▶ Small dose counter
- ▶ Need for spacer
- ▶ Prime: with every new device, if not used for more than 1 week, if dropped
- ▶ Expires after 200 doses or 12 months
- ▶ Clean once a week and wipe mouthpiece with a cloth
- ▶ Store upright

MDI with spacer



Remove cap and shake inhaler. Attach inhaler to spacer

Breathe out all the way. Place end of spacer into mouth, seal lips around the spacer.

Push down on the inhaler and **slowly** inhale until lungs are full

Hold breath for a count of 10 seconds

Slowly breath out

Dry-powder Inhaler (DPIs)



tiotropium

Spiriva Handihaler



fluticasone-umeclidinium-
vilanterol

Trelegy Ellipta



umeclidinium

Incruse Ellipta



fluticasone-salmeterol

Advair diskus



acclidinium

Tudorza Pressair



budesonide

Pulmicort Flexhaler

DPI: Steps for Use

1. Load dose (differs for each device)
2. Breath out gently, away from device
3. Seal lips around mouthpiece
4. Breathe in steadily and deeply (more forcefully than the MDI)
5. Hold breath for 10 seconds
6. Breath out away from device

DPI: Counseling Points

- ▶ Requires deep breath/force to aerosolize powder
- ▶ No hand-breath coordination required
- ▶ Inhalation time is important: breathe in steadily and deeply (more forcefully than the MDI)
- ▶ Some devices require opening a blister pack to prepare dose
- ▶ Priming NOT required
- ▶ Expires after 60 inhalations or 6 weeks
- ▶ Cleaning: Can wipe mouthpiece with cloth, DO NOT USE WATER
- ▶ Storage: Close mouthpiece, room temperature. Keep in a dry place away from heat and sunlight and away from pets/children

DPI: Ellipta

- ▶ Requires no hand-breath coordination
- ▶ Single-step dose activation
- ▶ Opening and closing cover will result in lost dose if not inhaled
- ▶ Call for refill when there are less than 10 doses left (**RED** appears in dose counter window).



DPI: Flexhaler

- ▶ Remove outer cover
- ▶ Grab the body with one hand and twist the brown grip to the right as far as it will go, and then twist it all the way back to the left until you hear a click, then inhale.
- ▶ Counter lets you know how many doses are remaining. It decreases by increments of 20, when it is all out it shows 0.



DPI: Twisthaler

- ▶ Hold at the base and twist the cap counterclockwise, you should hear a click
- ▶ Place cap back when done by twisting it clockwise until you hear a click
- ▶ Once counter reaches 00, cap will lock, and inhaler must be thrown away



Figure 1: Inhaler (upright position)

Figure 2: Inhaler with Cap Removed

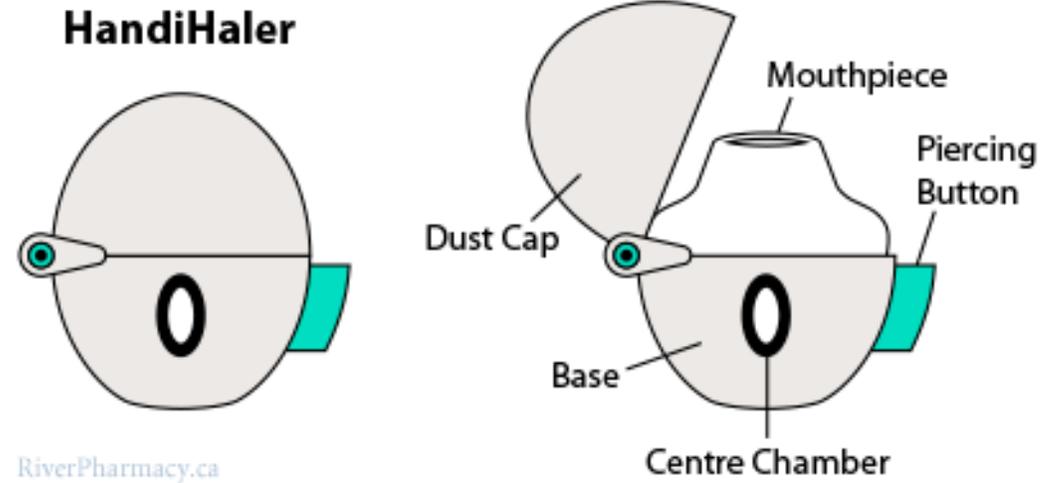
DPI: Diskus

- ▶ Open using thumb grip until you see mouthpiece, slide the lever away from mouthpiece until you hear it click, and inhale
- ▶ Dose counter will decrease by 1 each time lever is pulled; numbers will turn **RED** when there are only 5 doses left
- ▶ Must slide lever again to release another dose if taking 2 inhalations
- ▶ Patient should hold Diskus level and flat when inhaling (like a hamburger)
- ▶ Close using thumb grip when done



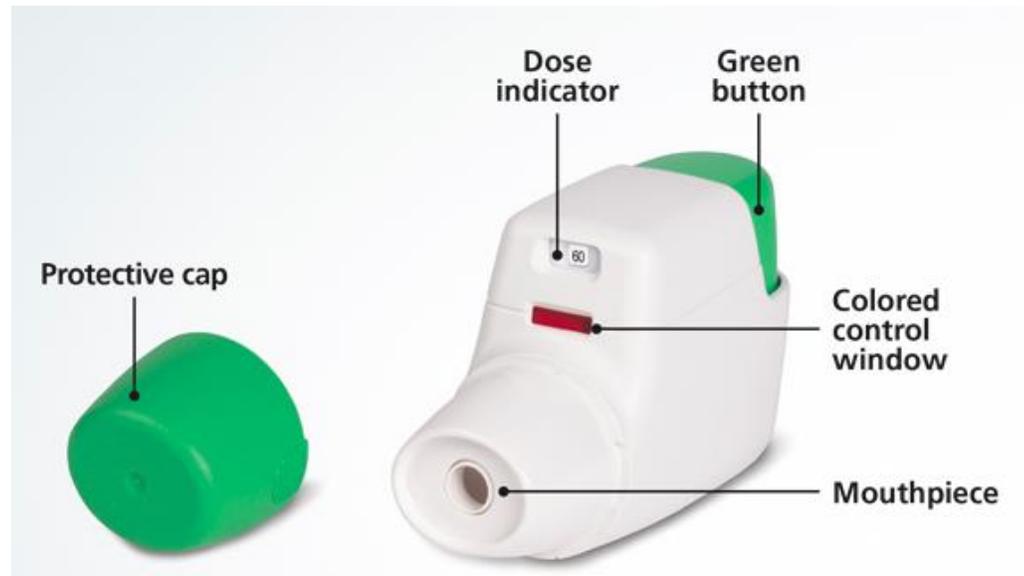
DPI: Handihaler

- ▶ Requires several steps for dose activation; dexterity and strength needed to prepare doses
- ▶ Do not swallow the capsule
- ▶ Do not press the piercing buttons more than 1 time
- ▶ Take 2 inhalations from one capsule
- ▶ Capsule should “rattle” when breathing in
- ▶ After use, remove the capsule from inhaler and throw it away



DPI: Pressair

- ▶ Ready-to-use with 3 steps
 1. PRESS green button all the way down
 2. RELEASE green button completely
 3. INHALE quickly and deeply
- ▶ **Green** control window means medicine is ready for inhalation
- ▶ Breathe in until a “click” sound is heard
- ▶ **RED** band will appear in dose indicator when 10 doses remain



DPI: Digihaler

- ▶ First DPI that uses Inhalation Flow Sensors technology
- ▶ You connect to the app through a QR code on the device
- ▶ The app registers when and how often the inhaler is used and measure inspiratory flow.
- ▶ Inhaler use is recorded as an event when the cap is opened or a patient inhales.
- ▶ Information is then uploaded to the app through Bluetooth® wireless technology, patient can review their data over time and share it with their healthcare provider.
- ▶ Used the same as a RespiClick



DPI: Digihaler Continued

Built-in Inhalation Flow Sensors

- Detect inhaler use, which is recorded as an event when the cap is opened or a patient inhales

Bluetooth® Wireless Technology

- Sends inhaler use information to the Digihaler app

Dose Counter

- Shows how many doses remain and when it's time for a refill

QR Code

- Scanned to register the inhaler with the Digihaler app

Battery

- Does not require charging or changing

Breath-actuated Dry-powder Delivery

- Eliminates the need for hand-breath coordination during inhalations
- Requires no shaking, priming, or washing and is designed to be used without a spacer

06



Breath Actuated Inhaler (BAI)



beclomethasone dipropionate HFA

QVAR ReditHaler

BAI: Steps for Use

- ▶ Remove Cap
- ▶ Hold upright and shake well
- ▶ Breathe out gently
- ▶ Seal lips around mouthpiece
- ▶ Inhale with **steady, moderate force** for at least 5 seconds
- ▶ Hold breath for 10 seconds
- ▶ Exhale
- ▶ Wait 1 min between doses

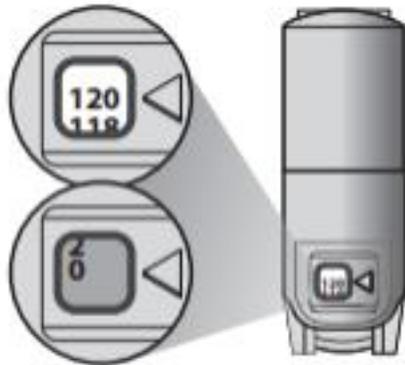
BAI: Counseling Points

- ▶ Priming not required
- ▶ Inhale with steady, moderate force
- ▶ Expires after 120 doses or 12 months
- ▶ Clean once a week, wipe mouthpiece with cloth (no water)
- ▶ Storage: keep the white cap on the inhaler closed during storage, upright and away from pets/children, at room temperature
- ▶ Do not cover vents
- ▶ Form a good seal around the mouthpiece of the inhaler or spacer

BAI: RediHaler

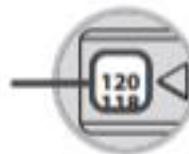


Inhaler Full
120 Doses



Inhaler Empty
0 Doses

Dose Counter



Soft Mist Inhaler (SMI)



tiotropium

Spiriva Respimat

SMI: Steps for Use

- ▶ Twist bottom of inhaler to prepare dose
- ▶ Open cap
- ▶ Breathe out gently
- ▶ Seal lips around mouth piece
- ▶ Start to slowly inhale and press firmly down on the button
- ▶ Continue to breath in slowly and steadily
- ▶ Hold breath for 10 seconds
- ▶ Exhale
- ▶ Wait 1 min between doses

SMI: Spiriva Respimat Steps for Use



Turn:
the clear base



Open: the green
cap and close
your lips around
the mouthpiece



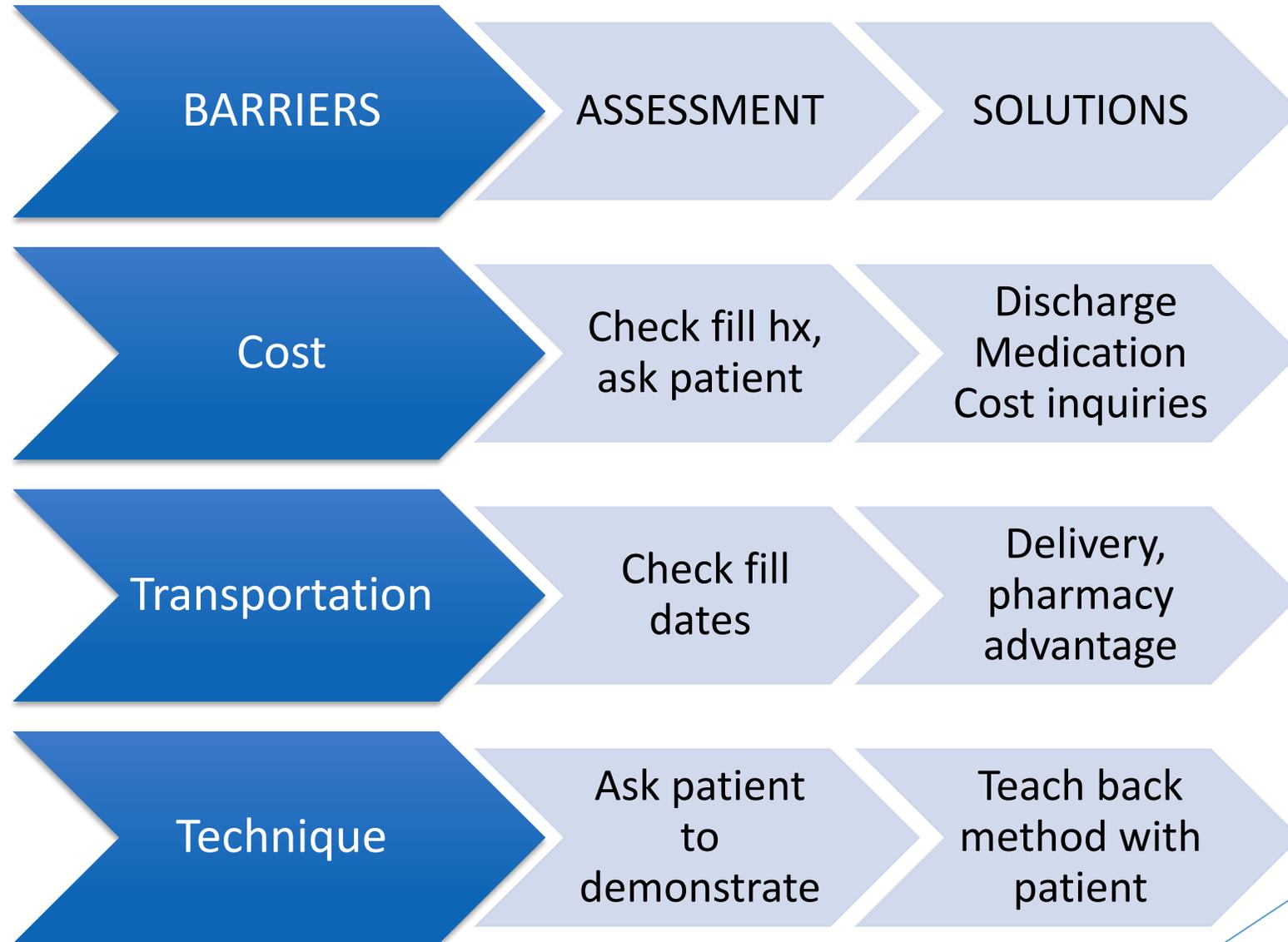
Press: the
dose-release
button and
inhale the mist

**Remember to tell your patients 1 dose = 2 puffs
Do not use more than 2 puffs every 24 hours**

SMI: Counseling Points

- ▶ Prime by spraying until mist is visible, then spray 3 more times before use or after 21 days of non-use. Spray once after 3 days of non-use
- ▶ Expires after 60 inhalations or 3 months
- ▶ Clean by wiping mouth piece with cloth once a week, do not use water
- ▶ Store away from pets/children
- ▶ There are multiple pieces that must be put together
- ▶ Requires some force to twist
- ▶ Form a good seal around the mouthpiece of the inhaler or spacer
- ▶ 1 dose = 2 puffs

Assessing Adherence: Examples of Barriers



Questions?

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