COPD Overview

A Crawley, BSP Sept 2015

What is it?
- Progressive, partially reversible airway limitation
- Damage to the walls of the lungs → reduced elasticity → reduced ability of patient to exhale
- 4th leading cause of death in Canada; prevalence ~5%
- Primary cause (85% of cases) is **smoking**
- An estimated 15-20% of smokers develop COPD

Symptoms: Cardinal triad: dyspnea, chronic cough, and sputum production. Dyspnea is typically progressive, worsens with exercise, persistent; described as gasping.
Definitions: Emphysema describes the damage to the lungs. Chronic bronchitis is defined as increased cough and sputum. Most COPD patients have features of both.
Diagnosis: Spirometry post-bronchodilator $FEV_1/FVC < 0.7$

Indicators: symptoms (dyspnea, cough, sputum), smoking history (10-20 pack-years or more), family history of COPD, environmental exposure to dust/chemicals. Screen for α_1-antitrypsin deficiency in select patients (e.g. if atypical features, disease onset <45 years).
Goals of therapy: ↓ dyspnea, ↑ exercise tolerance, ↑ quality of life, & ↓ complications such as exacerbations & cor pulmonale.
Comorbidities: common, especially depression and CV disease.

Therapeutic Pearls / Nonpharmacologic Approach FOR ALL PATIENTS

- An estimated 50% of patients are non-adherent to COPD therapy and 50% of patients cannot demonstrate **proper inhaler technique**! Reassess at every visit.
- Establish **individualized action plan** e.g. respiratoryguidelines.ca/updated-cts-copd-action-plan
- **Pulmonary rehab** has proven benefits in symptomatic and recently hospitalized patients (NNT = 4 to prevent one hospitalization in patients with recent exacerbation)
- Encourage **smoking cessation**. Benefits (40% ↓ in both death & rate of lung function decline) apparent even in severe COPD ("never too late to quit!")
- **Annual influenza vaccine** ↓ death by up to 50% and hospitalizations by up to 40%
- **Pneumococcal vaccine** recommended by guidelines (x1 dose, ?repeat in 5-10 years in severe COPD); however, only weak evidence of benefit available

An Approach to Treatment	Pharmacotherapy	General Agents
STEP 1: Start short-acting bronchodilators. **Start here if:** mild COPD, or $ barriers to LAMA or LABA	• **SAMA ± SABA** **Benefit:** ↓ symptoms, may not ↓ AECOPD/hospitalizations	• **SABA**: salbutamol VENTOLIN, terbutaline BRICANYL • **SAMA**: ipratropium ATROVENT • **Combo:** salbutamol/ipratropium COMBIVENT
STEP 2: Reassess inhaler technique.* Start long-acting agents. **Start here if:** moderate to severe COPD **Move here if:** treatment failure in Step 1	• **LAMA + SABA PRN** or **LABA + SABA PRN ± SAMA PRN** **Benefit:** ↓ symptoms, ↓ AECOPD/hospitalizations LAMA often preferred as it may have ↑ efficacy/tolerability vs LABA	• **LAMA:** tiotropium SPIRIVA, aclidinium TUDORZA, glycopyrronium SEEBRI, umeclidinium INCRUSE • **LABA**: formoterol OXEZE, salmeterol SEREVENT, indacaterol ONBREZ, olodaterol STRIVERDI
STEP 3: Reassess inhaler technique* Optimize long-acting agents. **Move here if:** treatment failure in Step 2	**Poor symptom control:** Maximize bronchodilator therapy first, since AE are associated with adding ICS • **LAMA & LABA + SABA PRN** **Benefit:** Limited evidence vs LAMA alone; may ↓ symptoms • **Poor symptom control despite LAMA + LABA:** **LAMA + (ICS+LABA) + SABA PRN** **Benefit:** Limited evidence vs LAMA+LABA; possibly ↓ symptoms	• **LAMA + LABA:** single agent products as above, or • **LAMA + LABA combinations:** aclidinium + formoterol DUAKLIR; glycopyrronium + indacaterol ULTIBRO; tiotropium + olodaterol INSPIOLTO; umeclidinium + vilanterol ANORO
	Frequent AECOPD (≥1 year): • **LAMA + (ICS+LABA) + SABA PRN** **Benefit:** ICS+LABA ↓ AECOPD/hospitalizations vs LABA alone {If on LAMA+LABA+ICS⇒ option to stop ICS: similar exacerbation risk} WISDOM	• **LABA + ICS combinations:** formoterol + budesonide SYMBICORT; salmeterol + fluticasone ADVAIR; vilanterol + fluticasone BREO
STEP 4: Reassess inhaler technique.* Specialist Referral.	• oxygen therapy • theophylline low dose UNIPHYL or roflumilast DAXAS • prophylactic azithromycin ZITHROMAX • n-acetylcysteine	
Move here if: COPD severe or unresponsive to therapy; α_1 antitrypsin deficiency; exacerbations severe/recurrent; respiratory failure; ? in diagnosis/management; symptoms disproportionate to FEV_1		

*Refer to a pharmacist or COPD Educator to review inhaler technique with the patient. Teaching sheets available online at www.RxFiles.ca & patient handouts at sk.lung.ca/health-professionals/resources/resptrec-resources

FEV_1	MRC	Symptom/Disability	COPD Stage
≥ 80%	1	Not troubled by breathlessness except with strenuous exercise.	At Risk
	2	Short of breath when hurrying on the level or walking up a slight hill.	Mild
50-79%	3	Walks slower than most people of the same age on the level because of breathlessness, or has to stop for breath when walking at own pace on the level.	Moderate
	4	Stops for breath after walking about 100 meters (~ 1 block) or after a few minutes on the level.	
30-49%	5	Too breathless to leave the house, or breathless when dressing or undressing.	Severe
< 30%			Very Severe

Should I choose a LAMA or a LABA?

Both will improve symptoms; LAMAs (tiotropium) may be superior in ↓ exacerbations (but unclear if this applies to newer agents). LAMAs may also be better tolerated than LABAs (↓ withdrawal in RCTs). Often in clinical practice, LAMAs are the preferred starting point.

Which LAMA / which LABA should I choose?

Consider: evidence (tiotropium, salmeterol, & formoterol are the most studied), device-specific advantages (see Asthma & COPD: Inhalation Devices), adherence (once vs twice daily regimens), & onset (see COPD: Drug Comparison Chart). If a patient frequently makes mistakes using their device, re-educate or consider a switch to an alternate device.

Management of AECOPD (acute worsening of symptoms over >48 hours): ❶ Initiate scheduled **salbutamol and ipratropium**; long-acting inhalers can be continued but should not replace short-acting bronchodilators. ❷ Initiate **prednisone** 30-50mg po daily x **5** REDUCE - 10days. ❸ **Add antibiotic if both** change in sputum purulence (colour) AND at least one of increased sputum volume or increased dyspnea vs baseline. Antibiotics should also be strongly considered if patient requires hospitalization. Antibiotic choice: amoxicillin, doxycycline, TMP/SMX, clarithromycin, azithromycin, cefuroxime, or cefprozil for low risk patients; amoxi-clav, levofloxacin, or moxifloxacin for high risk patients (high risk: severe COPD, coronary artery disease, chronic steroids, ≥ 4 exacerbations/yr, home oxygen, or recent antibiotics).

Prevention of AECOPD: optimization and adherence to meds; vaccinations (influenza, pneumococcal); avoid environmental triggers; smoking cessation; pulmonary rehab.

AE=adverse events **AECOPD**=acute exacerbation of COPD **CV**=cardiovascular **DPI**=dry powder inhaler **FEV_1**=forced expiratory volume in 1 second **FVC**=forced expiratory vital capacity **ICS**=inhaled corticosteroid **LABA**=long-acting Beta2-Agonist **LAMA**=long-acting muscarinic antagonist **MRC**=Medical Research Council dyspnea scale **SABA**=short-acting Beta2-Agonist **SAMA**=short-acting muscarinic antagonist **TMP/SMX**=trimethoprim/sulfamethoxazole

COPD: Drug Comparison Chart [1,2,3,4,5,6,7,8]

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	GENERIC/TRADE (Strength & formulations)	USUAL DOSE [MAX DAILY DOSE]	COMMENTS / ADVERSE EVENT AE / CONTRAINDICATIONS CI / DRUG INTERACTIONS DI / MONITORING M	$/30 day
Anticholinergics	**Short-Acting Muscarinic Antagonist (SAMA)**: binds unselectively to pulmonary muscarinic receptors, reducing smooth muscle contraction. Duration 4-6 hours. 1st line in mild COPD.			
	Ipratropium **ATROVENT** P L 20mcg MDI; 250, 500 mcg/2mL nebs; inhalation soln (for dilution)	**HFA**: 40mcg (**2 puffs**) inhaled TID-QID [16 puffs/day] **Neb**: 500mcg (1 neb) inhaled TID-QID [2000mcg]	• Improves COPD symptoms; does not reduce exacerbations. Onset <20 min. • AE similar to LAMA; ↓ incidence of dry mouth vs tiotropium (less potent). Avoid eye contact (can precipitate acute glaucoma) - esepcially with nebs.	$ 33 **$ 195**
	Long-Acting Muscarinic Antagonist (LAMA): slow to dissociate from pulmonary M_3 receptors = long-lasting ↓ in smooth muscle contraction. For mod-sev COPD, or after SABA +/- SAMA failure.			
	Tiotropium **SPIRIVA** P L 18mcg cap ☎ ✆ ; 2.5mcg soft mist ✗ ⊗	**HandiHaler**: 18mcg (1 cap) inhaled once daily ⊘ SWALLOW [UPLIFT] **Respimat**: 5mcg **(2 puffs)** inhaled once daily	• Tiotropium: may ↓COPD exacerbations by 20-30%/yr. Other LAMAs: limited data but appear similar. {Respimat: ↑ bioavailability, previous CV concerns} • AE: dry mouth, cough, constipation, urinary retention, headache. Avoid eye contact. Rinse mouth after inhalation to ↓ dry mouth AE. Glycopyrronium < dry mouth vs tiotropium, but URTI and UTI. [GLOW5] • Tiotropium, glycopyrronium: may accumulate in renal impairment; clinical significance unknown. Aclidinium, umecledinium: not renally eliminated. • Fastest onset: glycopyrronium (<15 min).	$ 87 $ 87
	Aclidinium **TUDORZA** P L 400mcg DPI ☎ ✆	**Genuair**: 400mcg (1 puff) inhaled BID		$ 73
	Glycopyrronium **SEEBRI** P L 50mcg cap ☎ ✆	**Breezhaler**: 50mcg (1 cap) inhaled once daliy ⊘ SWALLOW [GLOW]		$ 73
	Umeclidinium **INCRUSE** P L 62.5mcg DPI ✗ ⊗	**Ellipta**: 62.5mcg (1 puff) inhaled once daily		$ 81
Sympathomimetics	**Short-Acting Beta$_2$-Agonist (SABA)**: binds to β_2 pulmonary receptors, which ↑ cAMP; cAMP responsible for the relaxation of bronchial smooth muscle. 1st line in mild COPD.			
	Salbutamol **VENTOLIN**, **g** P L 100mcg MDI; 200mcg DPI ✗ ⊗; 1.25, 2.5, & 5 mg/2.5mL nebs; inhal'n soln	**HFA**: 100-200mcg (1-2 puffs) inhaled QID prn [1200mcg] **Diskus**: 200mcg (1 puff) inhaled QID prn [1600mcg] **Neb**: 2.5mg inhaled QID prn [15mg]	• Improves COPD symptoms; does not reduce exacerbations. Useful as "rescue" therapy due to short onset (salbutamol <5 min; faster than SAMA). • AE: tremor, ↑ nervousness, ↑ HR (esp. neb), ↑QT, headache. At high doses: ↓ K^+, ↑ insulin secretion	$ 17 $ 38 **$ 107**
	Terbutaline **BRICANYL** 500mcg DPI P L	**Turbuhaler**: 500mcg (1 puff) inhaled QID prn [4000mcg]		$ 20
	Long-Acting Beta$_2$-Agonist (LABA): slow to dissociate from pulmonary β_2 receptors, resulting in long-lasting bronchodilation. For mod-severe COPD, or use after SABA +/- SAMA failure.			
	Formoterol **FORADIL**, **OXEZE** P L 12mcg caps ☎ ✆ ; 6mcg, 12mcg DPI ☎ ✆	**Aerolizer**: 12mcg (1 cap) inhaled BID ⊘ SWALLOW **Turbuhaler**: 6-12mcg inhaled BID [72mcg]	• LAMA vs LABA: both first line COPD therapy. Tiotropium shown to have greater reduction in exacerbations than salmeterol [POET]; unclear whether this is a class effect. LAMAs may ↑ tolerability vs LABAs (less discontinuation). • AE: tremor, ↑ HR. Similar AE to SABAs, but less substantial. Indacaterol: 18% incidence of cough following inhalation [INLIGHT]; may lessen after 1 week. • Fastest onset: indacaterol, formoterol, olodaterol, and vilanterol (<5 min). • Higher indacaterol doses (150, 300mcg) approved in Europe; not available in North America due to the potential for cardiovascular risk.	$ 69 $ 63
	Salmeterol **SEREVENT** P L 50mcg DPI ☎ ✆	**Diskus**: 50mcg (1 puff) inhaled BID		$ 77
	Indacaterol **ONBREZ** P L 75mcg cap ☎ ✆	**Breezhaler**: 75mcg (1 cap) inhaled once daily ⊘ SWALLOW		$ 65
	Olodaterol **STRIVERDI** P L 2.5mcg soft mist ✗ ⊗	**Respimat**: 5mcg **(2 puffs)** inhaled once daily		not set
Combinations	**SAMA + SABA combination**: useful as prn therapy in any stage of COPD, and as treatment for acute exacerbations of COPD.			
	Ipratropium + Salbutamol **COMBIVENT** P L 0.5+2.5mg/2mL nebs; 20+100mcg soft mist	**Respimat**: 20/100mcg (1 puff) inhaled QID prn [6 puffs] **Neb**: 0.5/2.5mg (1 neb) inhaled QID prn [4 nebs]	• In AECOPD: use high dose; may continue long-acting agents; limited evidence for combination over a single agent (but commonly used)	$ 44 **$ 113**
	LAMA + LABA combination: decreased cost and increased convenience vs using a LAMA + LABA in separate inhalers (but drug coverage for combo products varies)			
	Aclidinium + Formoterol **DUAKLIR** 400+12mcg DPI ✗ ⊗ P L	**Genuair**: 400/12mcg (1 puff) inhaled twice daily	• Data for dual therapy is limited, but evidence suggests a statistically significant, although not clinically significant, ↑ in quality of life & lung function. [SPARK] Dual therapy is reasonable in patients poorly controlled on monotherapy.	$ 98
	Glycopyrronium + Indacaterol **ULTIBRO** 50+110mcg DPI ☎ ⊗ P L	**Breezhaler**: 50/110mcg (1 cap) inhaled once daily ⊘ SWALLOW		$ 105
	Tiotropium + Olodaterol **INSPIOLTO** 2.5+2.5mcg soft mist ✗ ⊗ P L	**Respimat**: 5/5mcg **(2 puffs)** inhaled once daily		$ 85
	Umeclidinium + Vilanterol **ANORO** 62.5+25mcg DPI ☎ ⊗ P L	**Ellipta**: 62.5/25mcg (1 puff) inhaled once daily		$ 107
	LABA + Inhaled Corticosteroid (ICS) combination: addition of ICS further ↓ exacerbations vs LABA alone; useful in severe COPD if frequent exacerbations; withdrawal of ICS an option in some [WISDOM]			
	Formoterol + Budesonide **SYMBICORT** P L 6+100, 6+200 mcg DPI ☎ ✆	**Turbuhaler**: 12/400mcg (**2 puffs**) inhaled BID [24/800mcg]	• Choose LAMA over LABA+ICS: same ↓ in exacerbations, less AE & cost [INSPIRE] (Guideline-directed & evidence to support, but some ambiguity in the evidence). • Triple therapy (LAMA + LABA + ICS) is rational, but evidence is limited: may not ↓ exacerbations vs LAMA, but may ↑ quality of life & lung function • **Avoid** ICS monotherapy: increases mortality [TORCH] NNH = 87/yr vs LABA+ICS • AE: thrush 5% & hoarseness 5% (dose related: rinse mouth [swish & spit] after use; add a spacer when using an MDI), ↑ risk of pneumonia [NNH = 16 over 3 years vs LABA], may ↑ osteoporosis/fractures (conflicting evidence). • **BREO**: fluticasone furoate - more potent/longer lasting vs fluticasone propionate	$ 110
	Formoterol + Mometasone **ZENHALE** P L 5+100, 5+200 mcg DPI ✗ ⊗ (EDS asthma)	**HFA**: 10/200mcg (**2 puffs**) inhaled BID **Not officially approved for COPD**		$ 116
	Salmeterol + Fluticasone propionate **ADVAIR** P L 50+100, 50+250, 50+500 mcg DPI ☎ ✆	**Diskus**: 50/250mcg (1 puff) inhaled BID [100/1000mcg] (**ADVAIR HFA** 25+125, 25+250mcg **not officially COPD** approval)		$ 126 [**$ 175**]
	Vilanterol + Fluticasone furoate **BREO** P L 25+100mcg DPI ☎ ⊗	**Ellipta**: 25/100mcg (1 puff) inhaled once daily [SUMMIT]		$ 153
Other	Roflumilast **DAXAS** 500mcg tab ✗ ✆ P L	500mcg po once daily	AE: diarrhea, nausea, HA, abd pain, ↓wt. Rare: depression/suicide, ↑AST DI [3A4,1A2]: CBZ, phenobarb, phenytoin	$ 85
	Theophylline **LA**, **SR**, **UNIPHYL** P L 100, 200, 300, (400ˢ, 600ˢmg) [UNIPHYL] SR tabs	200-400mg SR po daily	Infrequently used due to AE/toxicity/DI. AE: ↑ HR, nausea, tremor M: HR, CNS effects (insomnia, irritability), serum levels (<83 µmol/L) DI CYP 3A4,1A2: ↓theo: CBZ, phenytoin, rifampin, smoking ↑theo: allopurinol, cimetidine, ciprofloxacin, erythromycin, febuxostat, fluvoxamine, norfloxacin, verapamil.	$ 15 - 24

⊘=Do not ☎=**EDS** ✗ =Non Forumulary Sask ✆=prior approval NIHB ⊗=not covered by NIHB **AECOPD**=acute exacerbation of COPD **CNS**=central nervous system **COPD**=chronic obstructive pulmonary disease **DPI**=dry powder inhaler **FEV_1**=forced expiratory volume in 1 second **HA**=headache **HR**=heart rate **HFA**=hydrofluoroalkane **inhal'n soln**=inhalation solution **MDI**=metered dose inhaler **URTI**=upper respiratory tract infection **UTI**=urinary tract infection **PDE**=phosphodiesterase

ASTHMA AND COPD: INHALATION DEVICES CHART

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There is no evidence to suggest one device works better than another. Poor inhaler technique: ↓ efficacy. Pt device dissatisfaction: ↓ adherence. Choose device based on pros/cons below & patient preference.

	beclomethasone QVAR ciclesonide ALVESCO fluticasone FLOVENT formoterol/mometasone ZENHALE salmeterol/fluticasone ADVAIR ipratropium ATROVENT salbutamol VENTOLIN 	olodaterol STRIVERDI salbutamol/ipratropium COMBIVENT tiotropium SPIRIVA tiotropium/olodaterol INSPIOLTO 	**HandiHaler:** tiotropium SPIRIVA   **Breezhaler:** glycopyrronium SEEBRI glycopyrronium/indacterol ULTIBRO indacaterol ONBREZ	formoterol OXEZE formoterol/budesonide SYMBICORT terbutaline BRICANYL 	salbutamol VENTOLIN salmeterol SEREVENT salmeterol/fluticasone ADVAIR 	aclidinium TUDORZA aclidinium/formoterol DUAKLIR 	umeclidinium INCRUSE vilanterol/fluticasone BREO vilanterol/umeclidinium ANORO 
DEVICE	**MDI**	**Respimat**	**HandiHaler, Breezhaler**	**Turbuhaler**	**Diskus**	**Genuair**	**Ellipta**
Description	Delivers aerosolized stream of medication over ~0.2 seconds.	Uses a spring to deliver a "soft mist" of medication over ~1.5 seconds.	Capsules containing medication are pierced, then powder inside is inhaled.	Dry powder inhaler containing a reservoir of medication.	Dry powder inhaler containing single dose blisters of medication.		
Pros	Low inspiratory flow ≈ 20L/min required		Breath-actuated: reduces need for hand-breath coordination				
	• Suitable for **all ages.** Note: spacer strongly recommended regardless of age (see comments below). • Spacer with a mask available for cognitive impairment, frail, < 5 years old, etc. • Can be used with mechanical ventilation (e.g. in critical care units)	• Slower actuation may improve technique vs MDI • **DOSE COUNTER:** numbered by interval (frequency of interval varies by medication); loading base **locks** to signal empty • **COMBIVENT** Respimat has cost advantage over **COMBIVENT** nebules. **INSPIOLTO** Respimat has cost advantage over other LAMA/LABA combos. **Note:** Pharmacies should pre-load the Respimat canister before dispensing	• Rattling or whirring heard if capsule's contents inhaled correctly. Can look to view empty capsules (and Breezhaler has clear capsules). • Low inspiratory effort needed • **DOSE COUNTER:** each capsule equals 1 dose; thus no dose counter required	• Few steps, easy to use (compared to HandiHaler or Breezhaler). • Dose is not lost even if base is twisted multiple times; however dose counter will no longer be accurate • **DOSE COUNTER:** every 20th dose numbered to give approximation of doses remaining	• **DOSE COUNTER:** displays exact number of remaining doses	• Simple to use & less errors during dose preparation vs HandiHaler • Provides visual (window changes **green** → **red**) & audible ("**click**") feedback when dose taken correctly • In one study, majority of patients (80%) preferred Genuair over HandiHaler. • **DOSE COUNTER:** every 10th dose numbered; loading button **locks** to signal empty	• Simple to use; one step to open & load dose. Sub-analysis of RCT data: 95% of asthmatics able to use correctly after only one demonstration • In one study, majority of patients (>60%) preferred Ellipta over MDI, Diskus, or HandiHaler. • **DOSE COUNTER:** displays exact number of remaining doses with **large** numbers
Cons	• **DOSE COUNTER:** most devices lack dose counter (exceptions: **ADVAIR, ZENHALE**) • Spacer can be cumbersome; however, if using only at home in the morning/evening, additional burden is low. • Susceptible to freezing • Requires priming (x 4 sprays) if not used for ≥ **5 days**	• Requires reasonable strength to spring-load dose • Incorrect rate of inhalation results in cough • Not approved for kids or for use with a spacer • New device to the market - limited real-world experience • Requires priming (until mist is visible, then 3 more sprays) if **first time use** OR if not used for ≥ **21 days**. Requires priming (x 1 spray) if not used for ≥ **3 days**.	• **Multi-step process:** may be difficult to use for patients with poor manual dexterity (eg: arthritic hands, Parkinson's disease) or cognitive impairment • Capsules are packaged in foil blisters; may be difficult to remove (for some) and are light and moisture sensitive • Patients have been known to swallow capsules instead of inhaling them. • Pieces of capsule may be inhaled if pierced more than once.	• Tipping device before inhalation (e.g. upside down) **can expel the dose** • When empty, remaining desiccant can still be heard - patients may think there are doses left • **DOSE COUNTER:** displays a "zero", but it can be difficult to tell when the indicator reaches this mark • Humidity/moisture (e.g. exhaling into device, storing in bathroom) can clump drug in reservoir	• Short expiry date after removal from protective packaging: **ADVAIR** = 1 month; **SEREVENT** = 6 weeks - Exception: **VENTOLIN** = 1 year • Medications for Diskus inhalers tend to be among the most expensive in their class	• Some patients may experience a bitter taste with aclidinium • New device to the market - limited real-world experience.	• No way to identify if proper inspiratory effort is being achieved • Short expiry date (6 weeks) after removal from protective packaging
				• Requires sharp, forceful inhalation of breath to get full dose - some patients (e.g. < 5 years old, some COPD patients with severe symptoms) will be unable to achieve adequate flow rate.			

COPD=chronic obstructive pulmonary disease **MDI**=metered dose inhaler **RCT**=randomized controlled trial

More inhalation devices listed & compared at www.rxfiles.ca

- **Use a spacer with an MDI:** ↑ drug delivery to lungs;↓ need for hand-breath coordination; ↓ systemic absorption; ↓ local adverse effects e.g. hoarseness & thrush with corticosteroids, dry mouth with anticholinergics.
- **If on more than one inhaler:** (1) consider using the same device for all medications; (2) use the bronchodilator first & the anti-inflammatory last; (3) wait ~5 minutes between puffs of different medications.
- **Nebulizer/compressor solution:** (available for budesonide, ipratropium, salbutamol, and salbutamol/ipratropium) expensive without added benefit versus spacer except possibly in very young & very old, drug entering room air may ↑ infection transmission, time consuming, & can affect eyes. Useful during exacerbations for patients in too much distress to use proper inhaler technique, but spacer preferred.
- **General inhaler technique:** (1) prepare dose, (2) breathe out, (3) inhale medication, (4) hold 10 seconds, (5) breathe out. (See RxFiles Inhaler Technique.) May take a **second breath** from dry powder devices to ensure the entire dose is inhaled. Rinsing mouth (and spitting) after anticholinergics and corticosteroids decreases side effects. Best to wait ~1 minute between puffs of the same medication.