

Salbutamol Metered Dose Inhaler and Nebule Shortage

TABLE 1: SUPPLIERS OF INHALED SALBUTAMOL¹

Product	Strength	DIN	Manufacturer
Pressurized Metered Dose Inhalers (pMDIs)			
Apo-Salbutamol HFA	100 mcg/actuation	02245669	APX
Salbutamol HFA		02419858	SAN
Teva-Salbutamol HFA		02326450	TEV
Ventolin HFA		02241497	GSK
Dry Powder Inhalers (DPIs)			
Ventolin Diskus	200 mcg/actuation	02243115	GSK
Nebules*			
PMS-Salbutamol	0.5 mg/mL	02208245	PMS
	1 mg/mL	02208229	
	2 mg/mL	02208237	
Teva-Salbutamol Sterinebs™ P.F.	1 mg/mL	01926934	TEV
	2 mg/mL	02173360	
Respirator Solution for Nebulization*			
Ventolin Respirator Solution	5 mg/mL	02213486	GSK
* Preferably use pMDI or DPI, if available. See note about nebulization in text. HFA = hydrofluoroalkane; P.F. = preservative-free			

Health Canada-approved indications of salbutamol pressurized metered dose inhaler (pMDI)² and salbutamol dry powder inhaler (DPI)³ include:

- the symptomatic relief and prevention of bronchospasm due to bronchial asthma, chronic bronchitis and other chronic bronchopulmonary disorders in which bronchospasm is a complicating factor; and
- the prevention of exercise-induced bronchospasm.

Health Canada-approved indications of salbutamol solutions for nebulization include^{4,5}

- the treatment of severe bronchospasm associated with exacerbations of chronic bronchitis and bronchial asthma.

Considerations and Non-Pharmacological Management:⁶⁻¹⁰

- Ensure proper inhaler technique and adherence.
- Recommend smoking cessation when applicable.
- Identify and avoid triggers, when possible, such as environmental allergens, pollution, and occupational irritants.
- Manage conditions that may exacerbate asthma: obesity, anxiety, depression, rhinitis, sinusitis, gastroesophageal reflux disease, seasonal allergies.
- Assess potential for medication-induced asthma.
 - Acetylsalicylic acid (ASA) and non-steroidal anti-inflammatory drugs (NSAIDs) may cause asthma exacerbations in some patients; they are generally not contraindicated in patients with asthma unless they have caused previous exacerbations.
 - Oral and ophthalmic beta-blockers may cause bronchospasm. Continuation/initiation of these agents should be under close supervision when benefits outweigh risks.
- Recommend strategies to prevent respiratory infections, including up-to-date vaccination for influenza, COVID-19, pneumococcal, pertussis, and respiratory syncytial virus.^{10,11}
- Encourage physical activity.
- Have written action plans. Example plans for chronic obstructive pulmonary disease (COPD) and asthma are available from the [Canadian Lung Association](#)¹² or the [Canadian Thoracic Society](#)¹³.

- For patients with COPD, refer to pulmonary rehabilitation if appropriate and available.
 - [Living Well with COPD](#)¹⁴ is a resource accessible to patients and healthcare professionals (requires free registration) that offers print and video resources, including at-home pulmonary rehabilitation exercises.

Therapeutic Alternatives/Considerations:

- Refer to Tables 2-5 for alternatives to salbutamol for use in asthma, exercise-induced bronchoconstriction (EIB), and COPD.
 - Availability of salbutamol and alternatives may fluctuate. **Inventory management, especially prevention of stockpiling, will be key.**
- Ensure optimal treatment of asthma and COPD.
 - See [CPS](#)⁶, [RxFiles](#)⁸, and [Global Initiative for Asthma \(GINA\) Management and Prevention 2024 update](#)¹⁰ for stepped-care asthma treatment.
 - Note the GINA guidelines recommend against SABA-only treatment of asthma of any severity in adolescents and adults.¹⁰ Some resources indicate short-acting beta₂-agonist (SABA)-only therapy may be considered in very mild asthma (e.g., no more than 2 days/week with symptoms).⁸ Inhaled corticosteroid (ICS) therapy is the cornerstone of treatment of moderate to severe asthma.^{6,8,10}
 - See [CPS](#)⁷, [RxFiles](#)⁹, and [Global Initiative for Chronic Obstructive Lung Disease \(GOLD\) guidelines](#)¹¹ for stepped-care COPD treatment.
- **Note:** In general, nebulization is not preferred because of cost and lack of benefit compared to pMDI with spacer.¹⁵ Nebulization generates aerosols, meaning potentially greater transmission of respiratory pathogens.¹⁵ However, in some cases, nebulization may be the only option. This is most likely to be the case in infants where few other relievers are appropriate.
- There are advantages and disadvantages to the various devices making some less appropriate for some patients. Patients for whom **device selection** may be important include children and those with reduced dexterity, those unable to achieve forceful inspiration, those with dementia, and those concerned about environmental impacts. RxFiles has resources to help [select the best device](#)¹⁵ and information on [inhaler technique](#)¹⁶.

Device selection may be a luxury.

TABLE 2: PHARMACOLOGIC AGENTS FOR RELIEF OF ASTHMA SYMPTOMS IN ADULTS AND ADOLESCENTS ≥12 YEARS OF AGE

Medication Dosage Form Strength	Dosage ⁶	Pharmacokinetics ¹⁷	Comments
Short-Acting Beta₂-Agonists (SABA)			
Salbutamol (Ventolin, g) pMDI 100 mcg/ACT	1-2 INH TID to QID PRN Max: 8 INH (800 mcg)/ day	Onset: 5-8 min (median) Duration: 3-6 h ²	Preferably use pMDI or DPI if available. See note about nebulization in text. GINA does not recommend treatment of asthma in adults and adolescents with SABA alone. ICS-containing controller treatment, either as-needed or daily is preferred. ¹⁰ Adverse effects ⁶ : nervousness, tremor, tachycardia, palpitations
Salbutamol (Ventolin) Diskus (DPI) 200 mcg/ACT	1 INH TID-QID PRN Max: 4 INH (800 mcg) / day	Onset: ~5 min Duration: 3-6 h ³	
Salbutamol (Ventolin, g) Nebules 2.5 mg/2.5 mL; 5 mg/2.5 mL	2.5 to 5 mg QID PRN Max: N/A	Onset: ≤5 min Duration: 3-6 h	
Salbutamol (Ventolin) Respirator solution 5 mg/mL	2.5 to 5 mg Q4-6H PRN ⁵ Max: 20 mg/day ⁵		
Terbutaline (Bricanyl®) Turbuhaler (DPI) 0.5 mg/ACT	1 INH Q4-6H PRN Max: 6 INH/day	Onset: 5 min Duration: 3-6 h	

Medication Dosage Form Strength	Dosage ⁶	Pharmacokinetics ¹⁷	Comments
Corticosteroid/Long-Acting Beta₂-Agonist (LABA) Combination			
Budesonide/ Formoterol (Symbicort®) Turbuhaler (DPI) 100 mcg/6 mcg per ACT; 200 mcg/6 mcg per ACT	Reliever therapy (200 mcg/6 mcg only): 1 INH PRN. Max 6 INH on any single occasion; 8 INH/day ¹⁸ Controller and reliever therapy: 1-2 INH BID or 2 INH once daily. Take 1 additional INH PRN in response to symptoms; if symptoms persist after a few min, an additional dose should be taken Max: 6 INH on any single occasion; 8 INH/day	(Formoterol) Onset: within 3 min Peak: within 15 min Duration: 12 h in most patients	LABA monotherapy should be avoided in asthma as it is associated with higher rates of death. Formoterol alone (Oxeze®) is not recommended as it relies on the patient to add ICS; fixed-dose combination products are preferred, if available. ⁶ Adverse effects ⁶ : sore mouth, sore throat, dysphonia, oral thrush (can be reduced by rinsing mouth or using spacer). Nervousness, tremor, tachycardia, palpitations.
Mometasone/ Formoterol (Zenhale®) pMDI 100 mcg/5 mcg per ACT	Controller and reliever therapy (OFF-LABEL): 2 INH BID Extrapolating from Symbicort®, take 1 additional INH PRN in response to symptoms; if symptoms persist after a few min, an additional dose should be taken Max: 6 INH on any single occasion; 8 INH/day See comments	(Formoterol) Onset: within 3 min Peak: within 15 min Duration: 12 h in most patients	See comments for Symbicort®. In addition: Evidence of reliever therapy with ICS/formoterol combination is available only for budesonide/formoterol and not mometasone/formoterol. However, it is reasonable to extrapolate for use in shortage situations only . Use only the 100 mcg/5 mcg strength if being used as reliever; the maximum daily dose is 800 mcg/20 mcg, ¹⁹ which is reached with controller dose when using the 200 mcg/5 mcg strength. Extrapolating from Symbicort®, up to 48 mcg formoterol/day is acceptable.
Short-Acting Antimuscarinic Antagonist (SAMA)			
Ipratropium (Atrovent®, g) pMDI 20 mcg/ACT	Off-label 2 INH Q6-8H PRN Max: 12 INH/day	Onset: within 15 min Peak: 1-2 h Duration: 2-4 h	Less effective and slower acting than salbutamol. ^{8,10} Preferably use pMDI, if available. See note about nebulization in text.
Ipratropium (g) Nebules 250 mcg/1 mL; 500 mcg/2 mL	Off-label 250-500 mcg Q6-8H PRN Max: N/A	Onset: within 15 min Peak: 1-2 h Duration: 4-5 h, up to 7-8 h in some	Useful alternative for patients who are unusually susceptible to tremor or tachycardia from beta ₂ -agonists. ⁶ May also be useful in beta-blocker-induced bronchospasm. ⁶ Adverse effects ⁶ : dry mouth, metallic taste; mydriasis and glaucoma if released into eye.

Medication Dosage Form Strength	Dosage ⁶	Pharmacokinetics ¹⁷	Comments
Short-Acting Muscarinic Antagonist (SAMA)/Short-Acting Beta₂-Agonist Combination (SABA)			
Ipratropium/ Salbutamol (Combivent®) Respimat 20 mcg/100 mcg per ACT	Off-label, moderate to severe exacerbation: 4-8 INH every 20 min, then PRN ¹⁷ Max: N/A	Based on individual ingredients (pMDI, not Respimat): Onset: 5-8 min (median) Duration: 2-4 h	May prevent hospitalizations in adults at risk of hospitalization with severe exacerbations. ⁶ Preferably use pMDI, if available. See note about nebulization in text.
Ipratropium/ Salbutamol (g) Nebules 0.5 mg/2.5 mg per 2.5 mL	Off-label 1 NEB Q4-6H PRN Max: N/A	Based on individual ingredients: Onset: ≤5 min Duration: 4-5 h, up to 7-8 h in some	Adverse effects ⁶ : dry mouth, metallic taste; mydriasis and glaucoma if released into eye. Nervousness, tremor, tachycardia, palpitations.
Long-Acting Beta₂-Agonist (LABA)			
Formoterol (Oxeze®) Turbuhaler (DPI) 6 mcg/ACT; 12 mcg/ACT	Off-label Extrapolated from Symbicort® (available only as 6 mcg → only use 6 mcg Oxeze®) 1 INH PRN Max: 6 INH on any single occasion; 8 INH/day See Comments	Onset: within 3 min Peak: within 15 min Duration: 12 h in most patients	LABA <u>monotherapy</u> should be avoided in asthma as it is associated with higher rates of death. Formoterol alone is not an appropriate reliever as it relies on the patient to add ICS ; fixed- dose combination products (e.g., Symbicort®) are preferred, if available. ¹⁰ Reserve as last resort and ensure patient takes with ICS.
ACT = actuation; BID = twice daily; DPI = dry powder inhaler; g = generics; H or h = hour(s); ICS = inhaled corticosteroid; INH = inhalation(s); max = maximum; min = minute(s); N/A = not available; NEB = nebule(s); pMDI = pressurized metered dose inhaler; PRN = as needed; Q = every; QID = four times daily; TID = three times daily			

TABLE 3: PHARMACOLOGIC AGENTS FOR RELIEF OF ASTHMA SYMPTOMS IN CHILDREN < 12 YEARS OF AGE

Medication Dosage Form Strength ¹	Dosage ²⁰	Pharmacokinetics ¹²	Comments
Short-Acting Beta₂-Agonists (SABA)			
Salbutamol (Ventolin, g) pMDI 100 mcg/ACT	<4 y: 2 INH Q4H PRN ²¹ Max: N/A 4-11 y: 2 INH TID-QID PRN Max: 600 mcg/day	Onset: 5-8 min (median) Duration: 3-6 h ²	Preferred agent when available. Preferably use pMDI or DPI if, available. See note about nebulization in text. pMDI plus spacer may be used in children <4 y, though no trials have been done to assess optimal dose. ²⁰ Adult doses may be required due to poor deposition.
Salbutamol (Ventolin) Diskus (DPI) 200 mcg/ACT	≥4 y: 1 INH TID-QID PRN Max: 800 mcg/day	Onset: ~5 min Duration: 3-6 h ³	Adverse effects ²⁰ : tachycardia, palpitations, nervousness, tremor, hypokalemia, restlessness, dizziness, headache, nausea.
Salbutamol (Ventolin, g) Nebules 2.5 mg/2.5 mL; 5 mg/2.5 mL	<5 y: 0.63-2.5 mg Q4H PRN ²¹ Max: N/A 5-12 y: 1.25-2.5 mg as a single dose QID PRN Max: 5 mg/dose	Onset: ≤5 min Duration: 3-6 h	
Salbutamol (Ventolin) Respiratory solution 5 mg/mL	5-12 y: 1.25-2.5 mg Q4-6H PRN Max: 4 doses/day		

Medication Dosage Form Strength ¹	Dosage ²⁰	Pharmacokinetics ¹²	Comments
Terbutaline (Bricanyl®) Turbuhaler (DPI) 0.5 mg/ACT	≥6 y: 1 INH PRN Max: 6 INH/day	Onset: 5 min Peak: 15-60 min Duration: 3-6 h	Adverse effects ²⁰ : tachycardia, palpitations, nervousness, tremor, hypokalemia, restlessness, dizziness, headache, nausea
Short-Acting Antimuscarinic Antagonist (SAMA)			
Ipratropium (Atrovent®) pMDI 20 mcg/ACT	Off-label <12 y: 1-2 INH Q6H ¹⁷ Max: 12 INH/day ¹⁷	Onset: within 15 min Peak: 1-2 h Duration: 2-4 h	Less effective and slower acting than salbutamol ^{8,10} and generally used only as an adjunct to SABAs for exacerbations in children. ^{20,21} Adverse effects ⁶ : dry mouth, metallic taste; mydriasis and glaucoma if released into eye.
Ipratropium (g) Nebules* 250 mcg/1 mL; 500 mcg/2 mL	Off-label <12 y: 250-500 mcg Q6-8H ¹⁷ Max: N/A	Onset: within 15 min Peak: 1-2 h Duration: 4-5 h, up to 7-8 h in some	
Short-Acting Muscarinic Antagonist (SAMA)/Short-Acting Beta2-Agonist Combination (SABA)			
Ipratropium/ Salbutamol (Combivent®) Respimat 20 mcg/100 mcg per ACT	Off-label Children able to use device: Extrapolated from individual dosing for acute symptom relief: 4-11 y: 1-2 INH TID-QID PRN Max: 6 INH/day	Based on individual ingredients (pMDI, not Respimat): Onset: 5-8 min (median) Duration: 2-4 h	Respimat not approved for children. ¹⁵ Use for acute symptom relief is off-label. Doses provided have been extrapolated from individual ingredient information and are not supported by any data. Only consider as last resort.
Ipratropium/ Salbutamol (g) Nebules 0.5 mg/2.5 mg per 2.5 mL	Off-label Extrapolated from individual dosing for acute symptom relief: <12 y: 0.5-1 NEB Q6-8H PRN Max: N/A	Based on individual ingredients: Onset: ≤5 min Duration: 4-5 h, up to 7-8 h in some	Preferably use Respimat if available. See note about nebulization in text. Respimat is designed so spacers should not be required; however, if needed, a spacer specifically for Respimat devices, Odapt™, is available. ^{22,23} There is also limited data in COPD patients using Respimat with AeroChambers. ²⁴ Adverse effects ⁷ : dry mouth, metallic taste; mydriasis and glaucoma if released into eye. Nervousness, tremor, tachycardia, palpitations.
ACT = actuation; COPD = chronic obstructive pulmonary disease; DPI= dry powder inhaler; g = generics; h or H = hour(s); INH = inhalation(s); max = maximum; min = minute(s); N/A = not available; NEB = nebule(s); pMDI = pressurized metered dose inhaler; PRN = as needed; Q = every; QID = four times daily; TID = three times daily; y = year(s)			

TABLE 4: PHARMACOLOGIC AGENTS FOR PREVENTION OF EXERCISE-INDUCED BRONCHOSPASM (EIB)

Regular physical activity should be encouraged in patients with asthma.^{6,8,10} EIB is often an indication of poorly controlled asthma⁸; optimize treatment with ICS.¹⁰ Avoiding exercise in extreme cold/ pollution (or covering mouth if unavoidable)²⁵ and warming up before exercise^{10,25} may help.

Medication Dosage Form Strength	Dosage (to be provided 15 min prior to exercises unless otherwise noted)	Comments
Short-Acting Beta₂-Agonists (SABA)		
Salbutamol (Ventolin, g) pMDI 100 mcg/ACT	4 to <12 y: 1-2 INH ² ≥12 y: 2 INH ²	Tachyphylaxis likely to develop if used >once/day. ^{25,26}
Salbutamol (Ventolin) Diskus (DPI) 200 mcg/ACT	≥4 y (incl adults): 1 INH ³	
Terbutaline (Bricanyl®) Turbuhaler (DPI) 0.5 mg/ACT	Off-label ≥6 (incl adults): 1 INH ²⁰	
Long-Acting Beta₂-Agonists (LABA)		
Formoterol (Oxeze®) Turbuhaler (DPI) 6 mcg/ACT; 12 mcg/ACT	≥6 y (incl adults): 6-12 mcg ²⁷ Max - children and adolescents: 24 mcg/24 h ²⁷ Max - adults: 48 mcg/24 h ²⁷	In patients with asthma, LABAs should not be used as monotherapy and should be used with ICS.^{25,26} Fixed-dose combination products (e.g., Symbicort®) preferred. Tachyphylaxis likely to develop if used >once/day. ^{25,26}
Salmeterol (Serevent®) Diskus (DPI) 50 mcg/ACT	Off-label Canada ≥4 y (incl adults): 1 INH 30 min before exercise; no more additional doses for next 12 h ¹⁷	
Leukotriene Receptor Antagonist (LTRA)		
Montelukast (Singulair®, g) Oral tablet 10 mg Oral chewable tablet 4 mg, 5 mg Oral granules 4 mg	2-5 y: 4 mg PO once daily ²⁷ 6-14 y: 5 mg PO once daily ²⁵ ≥15 y: 10 mg PO once daily ^{8,25} Take ≥ 2 h prior to exercise ²⁵ Duration of action: 24 h ²⁶	Intended as prophylactic for EIB; ensure rescue treatment available. ²⁸ Useful for those exercising for prolonged durations (e.g., >3 h) or more than once daily. ²⁶ Be aware that neuropsychiatric events, including suicidal ideation, associated with montelukast have been reported in pediatric, adolescent and adult patients. ¹⁹
Corticosteroid(CS)/Long-Acting Beta₂-Agonist (LABA) Combinations		
Budesonide/ Formoterol (Symbicort®) Turbuhaler (DPI) 100 mcg/6 mcg per ACT; 200 mcg/6 mcg per ACT	Off-label ≥12 y: 1 INH ²⁶	Good option for those already using (as controller or reliever). ¹⁰ This is the only ICS/LABA combination with evidence in EIB. ¹⁰ A different device formulation was used in studies, which is why it is off-label.
Short-Acting Antimuscarinic Antagonist (SAMA)		
Ipratropium (Atrovent®, g) pMDI (20 mcg/ACT)	Off-label ≥12 y: 2-4 INH ²⁵ 15-30 min prior to exercise	Time before use estimated based on time to onset of 15 min. ¹⁷ Less effective than SABAs but likely provides partial protection. ²⁶
Short-Acting Muscarinic Antagonist (SAMA)/Short-Acting Beta₂-Agonist Combination (SABA)		
Ipratropium/ Salbutamol (Combivent®) Respimat 20 mcg/100 mcg per ACT	Off-label ≥12 y: 2 INH See comments	No dosing information available regarding use of this product for EIB and is based on composite ingredients. Dose extrapolated from single-ingredient product information.
ACT = actuation; DPI= dry powder inhaler; EIB = exercise-induced bronchoconstriction; g = generics; h = hour(s); ICS = inhaled corticosteroid; incl = including; INH = inhalation(s); max = maximum; min = minute(s); pMDI = pressurized metered dose; PO = by mouth; y = year(s)		

TABLE 5: PHARMACOLOGIC AGENTS FOR RELIEF OF COPD SYMPTOMS⁷

Medication Dosage Form Strength	Dosage
Short-Acting Beta₂-Agonists (SABA)	
Salbutamol (Ventolin, g) pMDI 100 mcg/ACT	1-2 INH TID-QID PRN Max: 800 mcg/day Onset: 5-8 min ¹⁷
Salbutamol (Ventolin) Diskus (DPI) 200 mcg/ACT	1 INH TID-QID PRN Max: 800 mcg/day Onset: ~5 min ¹⁷
Salbutamol (Ventolin, g) Nebules* 2.5 mg/2.5 mL; 5 mg/2.5 mL	2.5-5 mg QID PRN Max: 15 mg/day ⁷ Onset: ≤5 min ¹⁷
Terbutaline (Bricanyl®) Turbuhaler (DPI) 0.5 mg/ACT	1 INH Q4-6H PRN Max: 3 mg Onset: 5 min ¹⁷
Short-Acting Muscarinic Antagonist (SAMA)	
Ipratropium (Atrovent®, g) pMDI 20 mcg/ACT	2-4 INH TID-QID ²⁹ Max: 12 INH/day ²⁹ Onset: 15-20 min ¹⁷
Ipratropium (g) Nebules* 250 mcg/1 mL; 500 mcg/2 mL	500 mcg TID-QID ⁹ Max: 2000 mcg/day ⁹ Onset: 15-20 min ¹⁷
Short-Acting Muscarinic Antagonist (SAMA)/Short-Acting Beta₂-Agonist Combination (SABA)	
Ipratropium/Salbutamol (Combivent®) Respimat 20 mcg/100 mcg per ACT	1 INH QID; additional doses PRN Max: 6 INH/day Onset: 5-8 min ¹⁷ (based on salbutamol)
Ipratropium/Salbutamol (g) Nebules* 0.5 mg/2.5 mg per 2.5 mL	1 NEB Q6H PRN Max: 4 NEB/day ⁹ Onset: 5-8 min ¹⁷ (based on salbutamol)
<p>* Preferably use pMDI or DPI, if available. See note about nebulization in text.</p> <p>ACT = actuation; COPD = chronic obstructive pulmonary disease; DPI = dry powder inhaler; H = hours; g = generics; INH = inhalation; Max = maximum; min = minutes; NEB = nebule(s); pMDI = pressurized metered dose inhaler; PRN = as needed; Q= every; QID = four times daily; TID = three times daily</p>	

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