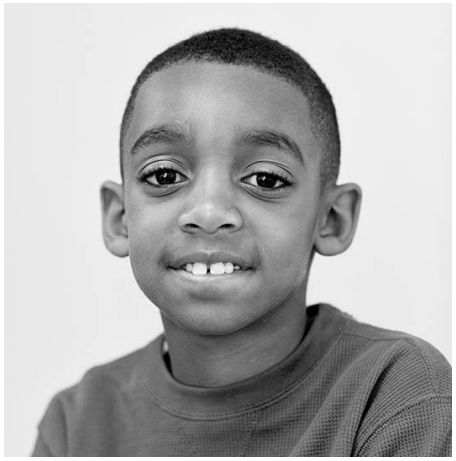

Initial Outpatient Evaluation and Ongoing Management of Asthma

Asthma Management Pathway

Diagnosis Tools:

Classifying Asthma Severity
Classifying Asthma Control
Differential Diagnoses for Asthma
Modifiable Risk Factors
Classifying Exacerbation Severity

Medications Charts:

Acute Exacerbation Dosing
Short-course Medications
Inhaled Corticosteroids (ICS)
ICS – Long-Acting Beta Agonist
SMART Dosing

PFK-OP Asthma Clinical Pathway
Published:7/5/2022 Revised: 12/20/2024

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When your child needs a hospital, everything matters.

Initial Outpatient Evaluation and Ongoing Management of Asthma

Diagnosis

Concern for new asthma diagnosis

- Are symptoms consistent with asthma?
  - No → Consider differential diagnosis
  - Yes → Classify and select therapy

Classify asthma severity

Routine follow-up visit

- Is asthma controlled?
  - No → Are there modifiable risk factors?
    - No → Consider step-up therapy
    - Yes → Address risk factors
  - Yes → Controlled for ≥ 3 months?
    - No → Maintain current therapy
    - Yes → Consider Step-down therapy

Classify asthma control

Acute asthma exacerbation

Classify exacerbation severity

- Can it be managed outpatient?
  - No → Refer to ED
  - Yes → Select treatment

Treatment

Age

Step 1 ⟷ Step 2 ⟷ Step 3 ⟷ Step 4 ⟷ Step 5 ⟷ Step 6

Consult with asthma specialist

Age	Intermittent	Mild Persistent	Moderate Persistent	Severe Persistent			Exacerbation
Age: 0-4	SABA PRN and short course daily ICS at start of RTI	Daily low-dose ICS and prn SABA	Daily medium-dose ICS and prn SABA	Daily medium-dose ICS-LABA and prn SABA	Daily high-dose ICS-LABA and prn SABA	Daily high-dose ICS-LABA + OCS and prn SABA	Treatment for acute exacerbation
Age: 5-11	SABA PRN	Daily low-dose ICS and prn SABA	Daily and prn low-dose ICS-formoterol #	Daily and prn medium-dose ICS-formoterol #	Daily high-dose ICS-LABA and prn SABA	Daily high-dose ICS-LABA + OCS and prn SABA	
Age: 12+	SABA PRN	Daily low-dose ICS and prn SABA or prn ICS and SABA	Daily and prn low-dose ICS-formoterol	Daily and prn medium-dose ICS-formoterol	Daily medium or high-dose ICS-LABA + LAMA and prn SABA	Daily high-dose ICS-LABA + OCS and prn SABA	

4 year olds can also be treated with this approach

Modified from 2020 NHLBI Asthma Focused Updates. For alternative treatment options click here.

Select a box above to see treatment options, or select categories to right for medication tables

SABA: Short-Acting Beta Agonist

ICS: Inhaled Corticosteroids

OCS: Oral Corticosteroids

LABA: Long-Acting Beta Agonist

Follow-up

Education/Follow-up

- Poorly Controlled?
  - No → Intermittent / Persistent / Stepping down
  - Yes → 1-2 months while gaining control

- Intermittent → 6 months to monitor control
- Persistent → 3-4 months to monitor control
- Stepping down → 3 months to monitor control

Patient Education Tools

Click here for PFK's Asthma Toolkit for Primary Care

- Medication handouts
- Asthma Action Plan Template
- Much more!!

2 weeks to review symptom control and medications

Referrals

School-based Asthma Therapy

Asthma Express

Asthma Specialist: Allergy Pulmonary

Consult with asthma specialist at **step 3** for patients younger than 5 years old or **step 4** for patients 5 and older

Differential Diagnosis Considerations for Asthma

Upper airway disease
- Allergic rhinitis and sinusitis

Obstruction involving large airways
- Foreign body in trachea or bronchus
- Vocal cord dysfunction
- Vascular ring or laryngeal web
- Laryngotracheomalacia, tracheal stenosis, or bronchostenosis
- Enlarged lymph nodes or tumor

Obstruction involving small airways
- Viral bronchiolitis or obliterative bronchiolitis
- Cystic fibrosis
- Bronchopulmonary dysplasia
- Heart disease

Other Causes
- Recurrent cough not due to asthma
- Aspiration from swallowing mechanism dysfunction or gastroesophageal reflux

Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. [Bethesda, Md.]: U.S. Dept. of Health and Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute, 2007. National Heart, Lung, and Blood Institute.

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Modifiable Risk Factors to Assess

Medication self-management barriers

- Poor controller adherence
- Lack of understanding of inhaler technique
- Poor understanding of asthma action plan
- Unable to access medication at the pharmacy
- Unable to obtain spacer

Asthma triggers

- Seasonal/environmental allergens
- Tobacco smoke (including vaping, second or third hand exposure)
- Mold
- Cockroaches
- Rodents
- Chemical exposures (e.g. incense)

Consider referral to asthma express

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Consider referral to school based asthma therapy (SBAT)

Classification of Asthma Severity: Clinical Features before Treatment

(*Modeled after NHLBI Guidelines*)

	Intermittent	Mild Persistent	Moderate Persistent	Severe Persistent
Daytime symptoms	≤ 2 days/week	> 2 days/week	Daily	Throughout the day
Nighttime symptoms*	≤ 2 times/month	3 – 4 times/month	> 1 time/week	Nightly
Rescue inhaler use	≤ 2 days/week	> 2 days/week	Daily	Several times a day
Exercise or Physical Activity Limitation	None	Minor	Some	Extremely
FEV1	>80%	>80%	60 – 80%	<60%
FEV1/FVC	>85%	>80%	75 – 80%	<75%
"Risk"	0 – 1 oral steroids/year	> 2 oral steroids per year		

*Frequency of nighttime symptoms for **0-4 year olds** are classified differently compared to older patients:
Intermittent: 0/month | Mild Persistent: 1-2/month | Moderate Persistent: 3-4/month | Severe Persistent: >1x/week

Assess clinical features in regard to patient/caregiver's recount of the previous 2-4 weeks. Classify based on one or more clinical features in most severe category.

Modified From: Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. [Bethesda, Md.]: U.S. Dept. of Health and Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute, 2007. National Heart, Lung, and Blood Institute.

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Classification of Asthma Control

Components of Control			Age (year)	Well-Controlled	Not Well-Controlled	Very Poorly Controlled
Impairment	Symptoms		All	≤ 2 days/week*	> 2 days per week#	Throughout the day
	Nighttime awakenings		0-4	≤ 1x/month	> 1x/month	> 1x/week
			5 to 11	≤ 1x/month	≥ 2x/month	≥ 2x/week
			≥ 12	≤ 2x/month	1-3x/week	≥ 4x/week
	Interference with normal activity		All	None	Some limitation	Extremely limited
	Short-acting beta2-agonist use for symptom control (not prevention of EIB)		All	≤ 2 days/week	> 2 days per week	Several times per day
	FEV1 or peak flow		≥ 5	> 80% predicted/ personal best	60-80% predicted/ personal best	< 60% predicted/ personal best
	FEV1/FVC		≥ 5	> 80%	75-80%	< 75%
	Validated Questionnaires	ACT	≥ 4	≥ 20	16-19	≤ 15
		ATAQ	≥ 12	0	1-2	3-4
		ACQ	≥ 12	≤ 0.75	≥ 1.5	N/A
Risk	Exacerbations requiring oral systemic corticosteroids¥		All	0-1/year	2-3/year	> 3/year
Recommended Action for Treatment			All	Maintain current step or consider step-down if well controlled for at least 3 months. Schedule regular follow-up in 1-6 months.	Step-up (1 step) and re-evaluate in 2-6 weeks. **Age 0-4:** If no clear benefit from stepping-up in 4-6 weeks, consider alternative diagnoses or adjust therapy.	Consider short course of oral systemic steroids, step-up (1-2 steps) and re-evaluate in 2 weeks **Age 0-4:** If no clear benefit from stepping-up in 4-6 weeks, consider alternative diagnoses or adjust therapy
* For 5-11 year olds: < 2 days/week but not more than once on each day # For 5-11 year olds: > 2 days/ week or multiple times on < 2 days/week ¥ Consider severity and interval since last exacerbation					Before stepping-up therapy, review adherence to medications, inhaler technique and environmental control.	
Abbreviations: EIB, Exercised-induced bronchoconstriction; FEV1, forced expiratory volume in 1 second; FVC, forced vital capacity; ACT, asthma control test; ATAQ, asthma therapy assessment questionnaire; ACQ, asthma control questionnaire;						

Modified From: Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. [Bethesda, Md.]: U.S. Dept. of Health and Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute, 2007. National Heart, Lung, and Blood Institute.

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CLASSIFYING SEVERITY OF ASTHMA EXACERBATIONS IN THE URGENT OR EMERGENCY CARE SETTING

Note: Patients are instructed to use quick-relief medications if symptoms occur or if PEF drops below 80 percent predicted or personal best. If PEF is 50–79 percent, the patient should monitor response to quick-relief medication carefully and consider contacting a clinician. If PEF is below 50 percent, immediate medical care is usually required. In the urgent or emergency care setting, the following parameters describe the severity and likely clinical course of an exacerbation.

	Symptoms and Signs	Initial PEF (or FEV_1)	Clinical Course
Mild	Dyspnea only with activity (assess tachypnea in young children)	PEF ≥70 percent predicted or personal best	• Usually cared for at home • Prompt relief with inhaled SABA • Possible short course of oral systemic corticosteroids
Moderate	Dyspnea interferes with or limits usual activity	PEF 40-69 percent predicted or personal best	• Usually requires office or ED visit • Relief from frequent inhaled SABA • Oral systemic corticosteroids; some symptoms last for 1-2 days after treatment has begun
Severe	Dyspnea at rest; interferes with conversation	PEF <40 percent predicted or personal best	• Usually requires ED visit and likely hospitalization • Partial relief from frequent inhaled SABA • Oral systemic corticosteroids; some symptoms last for >3days after treatment is begun • Adjunctive therapies are helpful
***Subset:* Life-Threatening**	Too dyspneic to speak; perspiring	PEF <25 percent predicted or personal best	• Requires ED/hospitalization; possible ICU • Minimal or no relief from frequent inhaled SABA • Intravenous corticosteroids • Adjunctive therapies are helpful

Key: ED, emergency department; FEV1, forced expiratory volume in 1 second; ICU, intensive care unit; PEF, peak expiratory flow; SABA, short-acting beta2-agonist

Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. [Bethesda, Md.]: U.S. Dept. of Health and Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute, 2007. National Heart, Lung, and Blood Institute.

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Asthma Exacerbation Severity and Treatments

Severity Classification		Mild			Moderate			Severe
Medication	Dosage form	Weight	Dose	Frequency	Weight	Dose	Frequency	**Call 911** **Monitoring:** Continuous HR, RR and pulse oximetry **Initiate Treatment, as outlined for Moderate severity**
Albuterol	Albuterol MDI (90mcg)	< 15 kg	4 puffs	Reassess in 20 minutes; may repeat x2				
		≥ 15 kg	8 puffs					
	Albuterol Nebulization (2.5mg/3mL vial)	All	3 mL	Reassess in 20 minutes; may repeat x2				
Ipratropium (use in combo with albuterol)	DuoNeb® (Ipratropium 0.5mg and albuterol 2.5mg per 3mL vial)				All	3 mL	Reassess in 20 minutes; may repeat x2	
Oral Steroids	*Prednisolone or prednisone	All	2 mg/kg (Max 60 mg)	**Daily** for 5 days	All	2 mg/kg (Max 60 mg)	**Daily** for 5 days	
	*Dexamethasone	All	0.6 mg/kg (Max 16 mg)	Once for 1 dose, then repeat dose in 24 – 48 hrs	All	0.6 mg/kg (Max 16 mg)	Once for 1 dose, then repeat dose in 24 – 48 hrs	
Next Steps		Repeat assessment: • If incomplete response, consider DuoNeb® treatment (Moderate dosing) • If responds well, review asthma action plan and send home • Patient should continue albuterol treatment scheduled every 4 hours for 24-48 hours and then use PRN dosing			Repeat assessment: • If incomplete response refer to ED or activate 911 • If responds well, review asthma action plan and send home • Patient should continue albuterol treatment scheduled every 4 hours for 24-48 hours and then use PRN dosing			

*For patients presenting with mild symptoms that have NOT tried albuterol to relieve symptoms, albuterol treatment should be completed first. If a complete response is observed, oral steroids may not be necessary.

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Short-Acting Beta-2 Agonists (SABA)

Mechanism of delivery	Drug	Strength	Dose and Frequency	Estimated Cost
Metered-dose Inhalers (MDI) • Shake before use • Needs primed • Use with spacer	**Ventolin®, Proventil®** **Albuterol sulfate HFA**	90 mcg	2 puffs as needed Every 4 hours*	$61
Nebulizer Solution • Passive inhalation via nebulizer • Requires nebulizer device	**Albuterol solution**	2.5 mg/3 mL (0.083%)	1 vial as needed Every 4 hours	$16

Mediglyph Patient Education Handouts

Intermittent Inhaled Corticosteroids (ICS)

Nebulizer Solution • Passive inhalation via nebulizer • Requires nebulizer device	**Pulmicort® Respules** **Budesonide**	1 mg/2mL solution	1 mg (1 ampule) BID for 7 to 10 days at first sign of respiratory illness	$150
Metered-dose Inhalers (MDI) • Shake before use • Needs primed • Use with spacer	**Fluticasone propionate HFA^**	110 mcg	2 puffs BID for 7 to 10 days at first sign of respiratory illness	$225

*Albuterol dose can be escalated to 4 – 6 puffs as needed based on symptoms. Instructions for dose increases should be part of the asthma action plan.
^Fluticasone propionate HFA dosing is the expert opinion of Nationwide Children's Hospital and is not described in the NHLBI guidelines. If fluticasone propionate HFA is not covered for privately insured patients, Asmanex® HFA 100 mcg 2 puffs BID, could be considered as an alternative option.

Systemic Corticosteroids

Drug	Strength	Dose, Frequency and Duration*	Maxiumum daily dose	Clinical Considerations
Orapred® **Prednisolone sodium phosphate**	Liquid: 15mg/5mL ODT: 10mg, 15mg, 30mg	2 mg/kg **Daily** for 5 days	60 mg/day	• Take with food • May increase appetite • May cause hyperactivity, consider dosing in the morning
Deltasone® **Prednisone**	Tablets: 1mg, 2.5mg, 5mg, 10mg, 20mg, 50mg	2 mg/kg **Daily** for 5 days	60 mg/day	
Decadron® **Dexamethasone**	Solution (injection for oral use)^: 4 mg/mL, 10 mg/mL Tablet: 1 mg, 2 mg, 4 mg, 6 mg	0.6 mg/kg/dose for two doses. Give second dose 24-48 hours after first dose.	16 mg/day	

*Duration of 5 days is average and typical duration for prednisolone and prednisone. Treatment may be shorter or longer depending on patient. Range 3 – 10 days of treatment. Do not need to taper if using for 10-days or less.
^If patient needs an oral preparation for dexamethasone, the injection for oral use will not be available at most community pharmacies. Dexamethasone tablets may be crushed and mixed with a small amount of sweet tasting food or drink, or consider prednisolone liquid.

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Estimated Comparative Daily Dosages for Inhaled Steroids*

If the medication is **BOLDED** it is covered without a prior authorization for patients on an Ohio Medicaid plan				Unless otherwise noted, doses represent the steroid component in **micrograms**					
Drug Mediglyph Patient Education Handouts	**Delivery Method**	**Strengths Available (inhalations/device)**	**Typical Dose Frequency**	**LOW DAILY DOSE**		**MEDIUM DAILY DOSE**		**HIGH DAILY DOSE**	
				Child (5-11)	**Teen/Adult (12 and older)**	**Child (5-11)**	**Teen/Adult (12 and older)**	**Child (5-11)**	**Teen/Adult (12 and older)**
Inhaled Steroids: Spacer compatible									
Fluticasone propionate[G] (Flovent® HFA)	Spacer compatible	44 mcg (120) 110 mcg (120) 220 mcg (120)	BID	88 - 176	88 - 264	>176 - 440	>264 - 660	>440	>660
Mometasone (Asmanex® HFA)	Spacer compatible	50 mcg (120) 100 mcg (120) 200 mcg (120)	BID	100	200	200	400	400	>400
Ciclesonide (Alvesco® HFA)	Spacer compatible	80 mcg (60) 160 mcg (60)	BID	80	160	160	320	>160	640
Inhaled Steroids: Breathe-actuated (not compatible with a spacer). Younger children may not have lung strength and proper technique to obtain dose.									
Beclomethasone (QVAR® Redihaler™)	Breath-actuated	40 mcg (120) 80 mcg (120)	BID	80 - 160	80 - 240	>160 - 320	>240 - 480	>320	>480
Budesonide[G] (Pulmicort Flexhaler™)	Breath-actuated	90 mcg (60) 180 mcg (120)	BID	180 - 360	180 - 540	>360 - 720	>540 - 1,080	>720	>1,080
Fluticasone propionate[G] (Flovent® Diskus®)	Breath-actuated	50 (60) 100 (60) 250 (60)	BID	100 - 200	100 - 300	>200 - 400	>300 - 500	>400	>500
Fluticasone furoate (Arnuity™ Ellipta™)	Breath-actuated	50 mcg (30) 100 mcg (30) 200 mcg (30)	Daily	50	100	100	200		
Mometasone (Asmanex® Twisthaler®)	Breath-actuated	110 mcg (multiple) 220 mcg (multiple)	Daily	110	220	220	>220 - 440	440	>440
Inhaled Steroids: Nebulizer Solution									
Budesonide[G] (Pulmicort Respules®)	Nebulized	0.25 mg/2 mL 0.5 mg/2 mL 1 mg/2 mL	Daily	0.5 mg		1 mg		2 mg	

Return to Pathway

Estimated Comparative Daily Dosages for Inhaled Steroids*

If the medication is **BOLDED** it is covered without a prior authorization for patients on an Ohio Medicaid plan				Unless otherwise noted, doses represent the steroid component in **micrograms**					
Drug Mediglyph Patient Education Handouts	**Delivery Method**	**Strengths Available (inhalations/device)**	**Typical Dose Frequency**	**LOW DAILY DOSE**		**MEDIUM DAILY DOSE**		**HIGH DAILY DOSE**	
				Child (5-11)	**Teen/Adult (12 and older)**	**Child (5-11)**	**Teen/Adult (12 and older)**	**Child (5-11)**	**Teen/Adult (12 and older)**
Inhaled Steroid and Long-Acting Beta Agonists: Spacer Compatible									
Budesonide/formoterol[G] (Symbicort® HFA)	Spacer compatible	80/4.5 mcg (120) 160/4.5 mcg (120)	BID	160 - 320	320	>320 - 640	640		
Fluticasone/salmeterol[G] (Advair® HFA)	Spacer compatible	45/21 mcg (120) 115/21 mcg (120) 230/21 mcg (120)	BID	90 - 180	180	460	460	920	920
Mometasone/formoterol (Dulera® HFA)	Spacer compatible	50/5 mcg (120) 100/5 mcg (120) 200/5 mcg (120)	BID	100	200	200	400	400	800
Inhaled Steroid and Long-Acting Beta Agonists: Breathe-actuated (not compatible with a spacer). Younger children may not have lung strength to obtain dose.									
Fluticasone/salmeterol[G] (Advair Diskus®)	Breath-actuated	100/50 mcg (60) 250/50 mcg (60) 500/50 mcg (60)	BID	200	200	500	500	1000	1000
Fluticasone furoate/vilanterol[G] (Breo™ Ellipta™)	Breath-actuated	50/25 mcg (30) 100/25 mcg (30) 200/25 mcg (30)	Daily	50	100	100	200		

G: Generic is available. When generic and brand are available, Ohio Medicaid prefers brand over generic (except for Flovent®, since brand not in marketplace).
HFA: Hydrofluoroalkane, a propellant most commonly used in metered dose inhalers.

*When available, these comparative dosages were obtained from the 2007 NAEPP Expert Panel Report 3 (EPR3). If not available in EPR3, the 2023 Global Initiative for Asthma guidelines were referenced.

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Estimated Comparative Daily Dosages for Inhaled Steroids*

If the medication is **BOLDED** it is covered without a prior authorization for patients on an Ohio Medicaid plan				Unless otherwise noted, doses represent the steroid component in **micrograms**		
Drug Mediglyph Patient Education Handouts	**Delivery Method**	**Strengths Available (inhalations/device)**	**Typical Dose Frequency**	**LOW DAILY DOSE**	**MEDIUM DAILY DOSE**	**HIGH DAILY DOSE**
				0-4 year olds	**0-4 year olds**	**0-4 year olds**
Inhaled Steroids: Spacer compatible						
Fluticasone propionate[G] (Flovent® HFA)	Spacer compatible	44 mcg (120) 110 mcg (120) 220 mcg (120)	BID	88 - 176	>176 - 440	>440
Inhaled Steroids: Nebulizer Solution						
Budesonide[G] (Pulmicort Respules®)	Nebulized	0.25 mg/2 mL 0.5 mg/2 mL 1 mg/2 mL	Daily	0.5 mg	1 mg	2 mg
Inhaled Steroid and Long-Acting Beta Agonists: Spacer Compatible						
Budesonide/formoterol[G] (Symbicort® HFA)	Spacer compatible	80/4.5 mcg (120) 160/4.5 mcg (120)	BID	160 - 320	>320 - 640	
Fluticasone/salmeterol[G] (Advair® HFA)	Spacer compatible	45/21 mcg (120) 115/21 mcg (120) 230/21 mcg (120)	BID	90 - 180	460	920
Mometasone/formoterol (Dulera® HFA)	Spacer compatible	50/5 mcg (120) 100/5 mcg (120) 200/5 mcg (120)	BID	100	200	400

G: Generic is available. When generic and brand are available, Ohio Medicaid prefers brand over generic (except for Flovent®, since brand not in marketplace).
HFA: Hydrofluoroalkane, a propellant most commonly used in metered dose inhalers.

*When available, these comparative dosages were obtained from the 2007 NAEPP Expert Panel Report 3 (EPR3). If not available in EPR3, the 2023 Global Initiative for Asthma guidelines were referenced.

^For patients 0-4 years old there are only equivalent dose recommendations in guidelines for fluticasone propionate HFA and nebulized budesonide. For other medications in this table, the suggested reference doses provided are the expert opinion of clinicians at Nationwide Children's Hospital.

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Single Maintenance and Reliever Therapy (SMART)

ICS + Long-Acting Beta Agonist (LABA)

BOLD = Preferred, no PA required for Medicaid patients

Inhaler Mechanism	Drug	Age (years)	Low Dose Inhaler Strength	Medium Dose Inhaler Strength	Dose and Frequency	Max Dose
Metered-dose Inhalers (MDI) • Aerosolized inhalation that is pushed to activate • Shake before use • Needs primed • Use with spacer	**Symbicort® HFA** **Budesonide / formoterol**	4-11	80-4.5 mcg	160-4.5 mcg	1 to 2 puffs BID and 1 puff PRN	8 puffs
		≥ 12				12 puffs
	Dulera® HFA Mometasone / formoterol	4-11	50-5 mcg	100-5 mcg	1 to 2 puffs BID and 1 puff PRN	8 puffs
		≥ 12				12 puffs

Example Prescription – Low Dose ICS + LABA

Age (years)	Drug	Strength	Directions
4-11	**Symbicort® HFA** Budesonide / formoterol	80-4.5 mcg	Inhale 2 puffs by mouth with spacer twice daily. May also inhale 1 puff as needed for symptoms (Max: 8 total puffs per day). Dispense 2 inhalers for 30-day supply.
≥ 12	**Symbicort® HFA** Budesonide / formoterol	80-4.5 mcg	Inhale 2 puffs by mouth with spacer twice daily. May also inhale 1 puff as needed for symptoms (Max: 12 total puffs per day). Dispense 2 inhalers for 30 day supply.

Expert Panel Working Group of the National Heart, Lung, and Blood Institute (NHLBI) administered and coordinated National Asthma Education and Prevention Program Coordinating Committee (NAEPPCC), Cloutier MM, et al. 2020 Focused Updates to the Asthma Management Guidelines: A Report from the National Asthma Education and Prevention Program Coordinating Committee Expert Panel Working Group. J Allergy Clin Immunol. 2020 Dec;146(6):1217-1270.

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