

INCLUSION CRITERIA

Children ≥ 2 years old with a history of asthma or wheezing necessitating albuterol use who present with symptoms of asthma exacerbation or wheezing

EXCLUSION CRITERIA

- Anaphylaxis
- Pneumonia
- Cardiac disease requiring chronic medications
- Cystic fibrosis
- Immunodeficiency
- Suppurative lung disease
- Tracheostomy
- Sickle cell disease
- Medically complex
- Impending respiratory failure

MEASURES

- Respiratory score utilization
- HLOS
- Readmission for asthma within 30 days

¹ALBUTEROL ADMINISTRATION

- MDI with spacer preferred for intermittent dosing

²CLINICAL DETERIORATION SIGNS

- Lethargy
- Bradypnea
- Worsening hypoxemia

LABS TO CONSIDER

If NPO or on continuous albuterol for > 24 hrs.:

- BMP

Labs to Consider if Calling RRT

- Venous blood gas
- BMP
- If received magnesium, Mg serum level

DIFFERENTIAL DIAGNOSES

- Foreign body (FB) aspiration
- Pneumonia
- Croup
- Heart failure
- Anaphylaxis

NOT ROUTINELY RECOMMENDED

- CXR, unless focal exam findings, concern for FB, prolonged course of illness, persistent need for respiratory support or failure to improve as expected
- Antibiotic

DISCHARGE CRITERIA

- Pulse ox $\geq 90\%$
- Tolerating oral intake

- Utilize Asthma Exacerbation Clinical Pathway Order Set
- Consider obtaining IV access if any respiratory score is ≥ 9 or concern for clinical deterioration²
- Provide oxygen/respiratory support PRN to achieve oxygen saturation of $\geq 90\%$
- Show Asthma medication patient education videos
- Start Asthma Action Plan for discharge
- Determine initial phase based on respiratory score

Phase I (Provider admission respiratory score ≥ 7)

- Give continuous albuterol nebulize
- Respiratory therapy assessment Q2 hours or for clinical deterioration²
- Continuous cardiorespiratory monitoring
- Dexamethasone (preferred), OR methylprednisolone, OR prednisolone/prednisone
- Consider famotidine if on continuous nebulized albuterol and IV steroids
- Consider IV magnesium sulfate if not already given. If repeating dose within 12 hrs., consider contacting PICU/ call RRT
- Clear liquid diet if no concern for clinical deterioration²
- If concern for clinical deterioration², consider RRT

Respiratory score 1-6?

No

Yes

Phase II (Provider admission respiratory score 5-6)

- Give albuterol¹ Q2 hrs. for a minimum of two doses with respiratory therapist assessment
- Continuous cardiorespiratory monitoring

Respiratory score?

9-12

5-8

Return to Phase I

1-4

Requiring supplemental oxygen?

Yes

No

Repeat Phase II

Phase III (Provider admission respiratory score 1-4)

- Give albuterol¹ treatment (high dose Q4 hrs. with respiratory therapist assessment)
- Continuous pulse-ox
- Continue steroids as necessary

Respiratory score?

5-8

9-12

Repeat Phase III

Requiring supplemental oxygen?

Yes

No

Return to Phase II

Phase IV

- Give albuterol¹ discharge dose (low dose) Q4 hrs. with respiratory therapist assessment
- Spot check pulse-ox (unless hypoxia present)
- Continue steroids as necessary

Respiratory score?

9-12

5-8

Return to Phase III

Repeat Phase IV

Discharge Patient

- Discharge when criteria are met
- Asthma teach back and confirm understanding of asthma action plan
- Provide related educational resources and asthma education handouts
- PCP follow up within 2-3 days
- Pulmonology follow-up if severe exacerbation or poorly controlled at baseline

Discharge Medication

- Dexamethasone for 2 total doses or prednisone for 5 total days if not completed during admission
- Albuterol¹ Q4 hrs. for wheezing for 48 hrs. until seen by PCP
- Refer to Persistent Asthma Clinical Pathway to initiate or increase maintenance inhaled corticosteroid dosing by one step for 2-4 wks. and update asthma action plan
- Do not restart SMART therapy at discharge. SMART therapy should only resume after PCP assessment post discharge.
- Offer influenza vaccination prior to discharge when seasonally appropriate

Acute Care Respiratory Therapy Reference Tool

Phase	Respiratory Score	Action	Notify Provider
Current	In Phase 1 Respiratory Score is ≥ 7	Continue Current Phase	No
	In Phase 2, 3 and 4 Respiratory Score 5-8		
	If on supplemental oxygen		
Advance	In Phase 1 Respiratory Score ≤ 6	Advance to the next phase	Yes
	In Phase 2, 3 and 4 Respiratory Score ≤ 4		
	On room air		
Intensify	In Phase 2, 3 and 4 Respiratory Score is ≥ 9	Intensify to previous phase	Yes
	Respiratory score worsens by more than 2 within 1 hour after advancing		

Respiratory Score Guideline (Under 2) ORIGINAL

Variable	0 points	1 point	2 points	3 points
RR				
< 2 mo		<60	61-69	≥ 70
2-12 mo		≤ 50	51-59	≥ 60
1-2 yr		≤ 40	41-44	> 45
Retractions	None	Mild retractions: Subcostal or intercostal	Moderate retractions in 2 of the following: subcostal, intercostal, substernal, OR nasal flaring	Severe retractions in 3 of the following: subcostal, intercostal, substernal, suprasternal, supraclavicular, OR nasal flaring/head bobbing
Dyspnea <i>*Automatic score of 1 for enteric feeding device</i>	Normal feeding, vocalizations and play	1 of the following: difficulty feeding, decreased vocalization or agitation	2 of the following: difficulty feeding, decreased vocalization or agitated	Lethargic, inconsolable, refusing to take PO
Auscultation	No wheezing and/or clear breath sounds	End-expiratory wheeze only	Expiratory wheeze only (greater than end-expiratory wheeze)	Inspiratory/Expiratory wheeze OR diminished breath sounds OR both

Respiratory Score Guideline (Under 2) UPDATED

Variable	0 points	1 point	2 points	3 points
RR				
< 2 mo		<60	61-69	≥ 70
2-12 mo		≤ 50	51-59	≥ 60
1-2 yr		≤ 40	41-44	> 45
Retractions	None	Mild retractions: Subcostal or intercostal	Moderate retractions in 2 of the following: subcostal, intercostal, substernal, OR nasal flaring	Severe retractions in 3 of the following: subcostal, intercostal, substernal, suprasternal, supraclavicular, OR nasal flaring/head bobbing
Dyspnea	Normal feeding, vocalizations and activity	1 of the following: difficulty feeding, decreased vocalization or agitated	2 of the following: difficulty feeding, decreased vocalization or agitated	Stops feeding, no vocalization, drowsy or confused
Auscultation	No wheezing and/or clear breath sounds	End-expiratory wheeze only	Expiratory wheeze only (greater than end-expiratory wheeze)	Inspiratory/Expiratory wheeze OR diminished breath sounds OR both

Medications			
Medication	Route	Dose	Max. per Dose
IVF Bolus	IV	20 mL/kg	1000 mL
Dexamethasone	IV/PO	0.6 mg/kg/dose	16 mg
Magnesium Sulfate	IV	50 mg/kg/dose	2000 mg
Methylprednisolone/ Prednisone/ Prednisolone	IV/PO	Loading: 2 mg/kg	60 mg
		Maintenance: 1 mg/kg/dose	30 mg

If transitioning from dexamethasone to methylprednisolone, space dosing by 12-24 hrs.

Acute Care Albuterol Acute Treatment			
Weight	Dose		
	Albuterol MDI	Albuterol Nebulized	Albuterol Continuous
< 10 kg	4 inhalations	2.5 mg	5 mg/hr.
10-20 kg	8 inhalations	5 mg	10 mg/hr.
> 20 kg			15 mg/hr.

Ipratropium	
Weight	Dose
< 10 kg	250 mcg
10-20 kg	500 mcg
> 20 kg	

Albuterol Discharge (Low Dose)		
Weight	Dose	
	Albuterol MDI	Albuterol Nebulized
< 10 kg	2 inhalations	2.5 mg
10-20 kg	4 inhalations	
> 20 kg		

Clinical Pathway Abbreviations	
Abbreviation	Definition
ACT	Asthma Control Test
CBC with diff	Complete Blood Count with Differential
CXR	Chest-Xray
FEV1	Forced Expiratory Volume in 1 second
GERD	Gastroesophageal Reflux Disease
ICS	Inhaled Corticosteroid
IgE	Immunoglobulin E
LABA	Long-Acting Beta-Agonist
LAMA	Long-Acting Muscarinic Antagonist
LTRA	Leukotriene Receptor Antagonist
OCS	Oral Corticosteroid
PRN	As Needed
RAST	Radioallergosorbent Test
SABA	Short-Acting Beta-Agonist
SMART	Single Maintenance And Reliever Therapy

Disclaimer: The clinical pathways are based upon publicly available medical evidence and/or a consensus of medical practitioners at Nemours Children's Health ("Nemours") and are current at the time of publication. These clinical pathways are intended to be a guide for practitioners and may need to be adapted for each specific patient based on the practitioner's professional judgment, consideration of any unique circumstances, the needs of each patient and their family, and/or the availability of various resources at the health care institution where the patient is located.

VERSION MANAGEMENT

- Version 1.0 (3/31/2025): Go Live.

Questions about this pathway should be directed to clinicalpathways@nemours.org.

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- Besbes-Ouanes L, Nouria S, Elatrous S, Knani J, Boussarsar M, Abroug F. Continuous versus intermittent nebulization of salbutamol in acute severe asthma: a randomized, controlled trial. *Ann Emerg Med*. 2000;36(3):198-203. doi:10.1067/mem.2000.109169
- Cheuk DK, Chau TC, Lee SL. A meta-analysis on intravenous magnesium sulphate for treating acute asthma. *Arch Dis Child*. 2005;90(1):74-77. doi:10.1136/adc.2004.050005
- Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention. Updated May 2023. Accessed March 5, 2024. https://ginasthma.org/wp-content/uploads/2023/05/GINA-Main-report-2023_tracked-v-2022_202305_03-WMSA.pdf.
- Griffiths B, Ducharme FM. Combined inhaled anticholinergics and short-acting beta2-agonists for initial treatment of acute asthma in children. *Cochrane Database Syst Rev*. 2013;(8):CD000060. Published 2013 Aug 21. doi:10.1002/14651858.CD000060.pub2
- Hardasmalani MD, DeBari V, Bithoney WG, Gold N. Levalbuterol versus racemic albuterol in the treatment of acute exacerbation of asthma in children. *Pediatr Emerg Care*. 2005;21(7):415-419. doi:10.1097/01.pec.0000169433.91196.6a
- National Heart, Lung, and Blood Institute. 2020 focused updates to the asthma management guidelines: clinician's guide. Accessed March 5, 2024. https://www.nhlbi.nih.gov/sites/default/files/publications/Asthma%20Clinicians%20Guide%20508_02-03-21.pdf.
- Qureshi F, Zaritsky A, Welch C, Meadows T, Burke BL. Clinical efficacy of racemic albuterol versus levalbuterol for the treatment of acute pediatric asthma. *Ann Emerg Med*. 2005;46(1):29-36. doi:10.1016/j.annemergmed.2005.02.001
- Rank MA, Hagan JB, Park MA, et al. The risk of asthma exacerbation after stopping low-dose inhaled corticosteroids: a systematic review and meta-analysis of randomized controlled trials. *J Allergy Clin Immunol*. 2013;131(3):724-729. doi:10.1016/j.jaci.2012.11.038
- Rowe BH, Bretzlaff JA, Bourdon C, Bota GW, Camargo CA Jr. Intravenous magnesium sulfate treatment for acute asthma in the emergency department: a systematic review of the literature. *Ann Emerg Med*. 2000;36(3):181-190. doi:10.1067/mem.2000.105659