ED GUIDELINE | ASTHMA EXACERBATION

(2–18 years of age)

Children's MINNESOTA

Aim: To standardize ED management for children ≥ 2 yrs age with acute asthma exacerbation.

DISCHARGE CRITERIA:
See page 3 for discharge criteria.

RN perform initial assessment:
- VS (including pulse-ox)
- Assess work of breathing and air entry through lung auscultation
- Assess perfusion/hydration
- Perform **PRAM Score** (See page 3)

EXCLUSION GUIDELINES

Patients **excluded** from this guideline:
- Chronic lung disease (CF, bronchiectasis, PCD, immune def, IPHSS disease)
- Acute or chronic airway disorder (malacia, stenosis, croup, bronchiolitis)
- Acute pneumonia (aspiration, infectious)
- Cardiac or neurologic disorder

PRAM 0–3 Mild

MD 60 min

- Intermittent pulse oximetry
- Maintain O2 sat > 90%
- Albuterol 8 puffs MDI (or 5 mg neb)
- Ipratropium not indicated for mild cases
- Systemic steroids (for any PRAM ≥ 1); (page 4, prefer dexamethasone)
- CXR not routinely recommended

Repeat PRAM after intervention; if worse, move to *Moderate path*.

- Plan for discharge if PRAM remains ≤ 3

PRAM 4–7 Moderate

MD 60 min

- Continuous pulse oximetry
- Maintain O_2 sat > 90%
- Albuterol and ipratropium via 2–3 Duonebs
- Systemic steroids (page 4, prefer dexamethasone)
- CXR not routinely recommended

Repeat PRAM after intervention; if worse, move to *Severe path.*

- Consider admit 2 hrs post-steroid for PRAM ≥ 4
- Plan for discharge if PRAM ≤ 3
- Albuterol 8 puffs MDI Q2 hour until transferred to floor

Duoneb:

Albuterol	2.5 mg neb +
Ipratropium	0.5 mg for ≥ 2 yrs, 0.25 mg if < 2 yrs

PRAM 8–9 Severe

MD 60 min

- Continuous pulse oximetry, CR monitor
- O_2 to keep sats > 90%
- Duonebs x 3 (albuterol and ipratropium)
  - – Provider reassess within 10 mins of 3rd Duoneb. If still PRAM 8+ (severe), order continuous albuterol. Continue giving additional albuterol Q15 min until continuous albuterol initiated.
- High flow nasal cannula if needed to support work of breathing.
- Systemic steroids (page 4)
- Strongly consider magnesium sulfate IV 50 mg/kg x 1 (max 2 grams) if age ≥2 yo
  - – If giving magnesium, place PIV and consider giving 20 mL/kg NS bolus
- Consider budesonide 1 mg neb
- CXR not routinely recommended

Repeat PRAM after intervention. If worse, move to *Respiratory failure*.

Patient improved?

No:
- Initiate continuous albuterol
- Additional albuterol nebs/MDI Q15–30 min until continuous albuterol arrives
- Admit patient to med-surg unless concern for high O_2 support, high work of breathing or mental status changes necessitating PICU

Yes:
- Admit to med-surg
- Albuterol 8 puffs MDI Q2 hrs

PRAM 10–12 Respiratory failure — RESUS ROOM

MD STAT

- CR monitor, HOB elevated, continuous pulse oximetry
- O2 to keep sats > 90%
- Order albuterol continuous 20 mg/hr, provide Duonebs x 3 while waiting for continuous albuterol
  - – Order additional albuterol nebs q15 min if delay between completion of duonebs and initiation of continuous albuterol.
- High flow nasal cannula minimum 6 L 40% to deliver continuous albuterol
- Systemic steroids (page 4; prefer IV methylprednisolone 2 mg/kg once, max 125 mg)
- Place PIV, NS 20 mL/kg bolus
- Recommend magnesium sulfate IV 50 mg/kg x 1 (max 2 grams) if age ≥2 yo
- Consider budesonide 1 mg neb

Patient improved?

No:
- CXR and VBG
- Admit to PICU
- Consider intubation (See page 3)

Yes:
- Admit patient to med-surg unless concern for high O_2 support, high work of breathing or mental status changes necessitating PICU
- CXR and VBG if PRAM 11–12

INPATIENT GUIDELINE | ASTHMA EXACERBATION

(2–18 years of age)

Children's MINNESOTA

Aim: To standardize inpatient management for children ≥ 2 yrs age with acute asthma exacerbation.

EXCLUSION GUIDELINES

Patients **excluded** from this guideline:

- Chronic lung disease (CF, bronchiectasis, PCD, immune def, IPHSS disease)
- Acute or chronic airway disorder (malacia, stenosis, croup, bronchiolitis)
- Acute pneumonia (aspiration, infectious)
- Cardiac or neurologic disorder

Initial assessment within 15 min of arrival to floor

LRT: PRAM score (See page 3)

RN: Vital signs: HR, RR, BP, room air O_2 sat

APC/Physician: H+P within 1–2 hours

O_2 to keep sats > 90%. Continuous pulse-ox if on O_2 support.

Consider PICU if any of following:

- PRAM 9–12.
- PaCO2 ≥ 40 mmHg with PRAM ≥ 8.
- Sign of deterioration: anxiety, mental status change, increasing FiO2 requirement.
- Consider PICU consult if requiring continuous albuterol longer than 6–8 hrs.

PHASE IV: PRAM 0–3 (Mild)*

- CXR not routinely recommended
- LRT to complete PRAM assessment Q4
- Albuterol 4 puffs MDI Q 4 hrs
- **At transition to Q 4 hrs, send outpatient scripts to pharmacy**
- Systemic steroids (page 4, prefer dexamethasone)

PHASE III: PRAM 4–7 (Moderate)*

- CXR not routinely recommended
- LRT to complete PRAM assessment Q4
- Albuterol 8 puffs MDI Q 4 hrs
- Systemic steroids (page 4, prefer dexamethasone)

If PRAM score after reassessment is <4, advance to Phase IV

PHASE II: PRAM 8–9 (Severe)*

- CXR not routinely recommended
- LRT to complete PRAM assessment Q2
- Albuterol 8 puffs MDI Q 2 hrs (5 mg nebulized if on high flow)
- Systemic steroids (page 4, prefer dexamethasone)
- Consider checking potassium if on continuous albuterol > 8 hours

If PRAM score after reassessment is <8, advance to Phase III

PHASE I: PRAM 10–12 (Respiratory failure)*

- LRT to complete PRAM assessment Q1
- Provider to assess Q1–2 hr to determine ability to transition off continuous albuterol
- Albuterol continuous 20 mg/hr for all patients 2 yrs and older
- Systemic steroids (page 4, prefer IV methylprednisolone 1 mg/kg q6 hours, max 60 mg per dose)
- Magnesium sulfate IV 50 mg/kg x 1 (max 2 grams) if age ≥ 2 yo (See page 4)
- CXR, VBG
- Consider checking potassium if on continuous albuterol > 8 hours or on prolonged duration of Q 2 dosing

If PRAM score after 1 hr of treatment is <10, advance to Phase II

HANDOFF CHECKLIST:

- ☐ Acute history: illness days, acute triggers, potential anaphylaxis, respiratory support
- ☐ Past asthma history: current AAP, compliance, prior PICU/hospitalizations/911 calls
- ☐ Initial assessment: room air O2 sat, RR, severity
- ☐ Interventions: nebs/MDI, steroids, magnesium, oxygen
- ☐ Current assessment: room air O2 sat, RR, severity, time of last albuterol
- ☐ Change or intervention with transport if applicable

*PHASE ADVANCEMENT:

- Advance after *a minimum* of one treatment at each phase if PRAM score decreases on assessment. Advance phase as above.
- **If PRAM score *increases* on assessment in PHASE II–IV,** give PRN albuterol 8 puffs MDI or 5 mg neb and reassess
  - **If improved,** continue at current phase
  - **If not improved,** give 2nd PRN albuterol and notify APC/Physician

DISCHARGE CRITERIA:

See page 3 for discharge criteria

ED GUIDELINE

ASTHMA EXACERBATION

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PRAM Scoring Table		
O_2 Saturation	≥ 95%	0
	92–94%	1
	< 92%	2
Suprasternal retractions	Absent	0
	Present	2
Scalene muscle retractions	Absent	0
	Present	2
Air Entry	Normal	0
	Decreased at bases	1
	Decreased at apex and bases	2
	Minimal or absent	3
Wheezing	Absent with good air movement	0
	Expiratory Only	1
	Biphasic	2
	Audible without a stethoscope or silent chest	3
PRAM Score (Max. 12)		

Severity	Mild	Moderate	Severe/ Resp failure
Score	0–3	4–7	8–12

DISCHARGE CRITERIA:

- Discharge only from Phase IV (inpatient), observe for minimum of two hours after initial treatment in Phase IV
- Room air sat ≥ 90%, PRAM ≤ 3
- Education: triggers, mask/inhaler/space
- Asthma action plan (AAP) provided
- Medications reviewed. Stress use of spacer/mask with inhalers.
- Adequate PO intake
- Family support in place
- Follow-up in place: Primary clinic appointment in 1–2 days. Subspecialty clinic if appropriate, consider home assessment, school support

PRE-INTUBATION CHECKLIST:

- ☐ Review meds, allergies, last meal
- ☐ Prior intubation history
- ☐ Head of bed elevated
- ☐ Equipment checklist
- ☐ Bag/mask O_2/flow/suction
- ☐ Nasal cannula for high-flow in RSI
- ☐ Positioning: ear-sternal notch
- ☐ Capnography, back-up plan
- ☐ Assured IV access, 20 mL/kg NS bolus

INTUBATION CHECKLIST:

- ☐ Rapid sequence intubation
- ☐ Ketamine 2 mg/kg IV
- ☐ Rocuronium 1 mg/kg IV
- ☐ RSI, inflate cuff ETT, ongoing sedation
- ☐ NG/OG, record ETT number at lip
- ☐ 100% oxygen, low rate, long expiratory time
- ☐ CXR before transfer

ASTHMA EXACERBATION

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Children's MINNESOTA

Aim: To standardize ED/inpatient management for children ≥ 2 yrs age with acute asthma exacerbation.

REFER HIGH-RISK ASTHMA TO PULMONARY

Definition: 1 major + 2 minor ***or*** 3 minor criteria

Major criteria:

- Oral corticosteroids ≥ 25%/yr
- High dose inhaled corticosteroid
- Any life-threatening asthma event
- ICU admit within 5 year

Minor criteria:

- Daily inhaled corticosteroid (ICS) + 2nd controller
- ≥ 3 steroid bursts/yr
- FEV1 ≤ 50% predicted, anytime
- Persistent FEV1 ≤ 80% predicted
- 2 ED visits or one hospitalization in last year
- Daily smoke exposure risk
- Daily environmental exposures
- Socioeconomic factors impacting disease
- Poor attitude/belief regarding meds
- Low or high perceiver of symptoms
- Kenalog injection(s) required
- History of anaphylaxis
- Co-morbid conditions
    - Sinus disease
    - Severe atopy
    - Obesity
    - Sickle cell disease
    - Chronic lung disease

MEDICATION DOSING

Magnesium Sulfate:

- 50 mg/kg IV (maximum dose 2 g) with 20 mL/kg (maximum dose 1000 mL) NS bolus for patients ≥ 2 yo
- Mag sulfate may be re-dosed at the same dose every 6 hours. If patient needs multiple doses should consider PICU.
- Key side effects include vasodilation and hypotension due to smooth muscle relaxation. Patients should have HR and BP closely monitored during infusion and for 60 minutes after infusion. Flushing of skin may occur.
- Strongly consider a fluid bolus of 10–20 mL/kg NS if giving magnesium sulfate, given risk of hypotension. Use caution if any concern for fluid overload.

MEDICATION DOSING continued

Albuterol:

All patients need a spacer with MDI. Many children, particularly those <5 yrs will also need a mask.

- 8 puffs by MDI for all patients (preferred route)
- 5 mg nebulized for all patients (use neb ONLY if patient intubated, tracheostomy, high flow nasal cannula or other indications)

* **Discharge Albuterol dosing:** 4 puffs by MDI *for all patients*

- Jitteriness, tachycardia, nausea and vomiting are common side effects of albuterol.

Duoneb: Albuterol 2.5 mg + 0.5 mg ipratropium (0.25 mg if < 2 yrs)

Ipratropium: (ED only, with albuterol treatment, not recommended after admission) 1.5 mg for 2 yrs and older, 0.75 mg for < 2 yrs (total dosing to be achieved by series of 3 duonebs). If given in ICU for status asthmaticus, discontinue when off continuous albuterol unless other indications.

Budesonide: (ED only)

1 mg nebulized

Systemic steroids*:

- Dexamethasone
    - 0.6 mg/kg PO, IV, or IM (max dose 12 mg) x 2 doses 24–48 hours apart
- Prednisolone/Prednisone
    - 1 mg/kg PO BID x 5 days (max 30 mg per dose)
- Methylprednisolone IV
    - ED loading dose for status asthmaticus: IV 2 mg/kg once (max 125 mg per dose)
    - While on continuous albuterol: 1 mg/kg IV q6 hrs (max 60 mg per dose)
    - Once spaced off continuous albuterol, transition to oral prednisolone/prednisone. If not tolerating PO, continue IV methylprednisolone 1 mg/kg BID (max 30 mg per dose)

*In non-ICU children, Dexamethasone and Prednisone have similar relapse rates, but dexamethasone has lower risk of vomiting. If there is failure of resolution or relapse of symptoms in a patient on dexamethasone, consider switching to prednisone.[1]

Inhaled Corticosteroids:

Not recommended inpatient when patients are receiving systemic steroids.

Aim: To standardize ED/inpatient management for children ≥ 2 yrs age with acute asthma exacerbation.

Workgroup: Asthma Committee (Herring), Januschka, Damas, Schultz, Raschka, Allen, Fontenot, Cavanaugh, Sicoli, Schwartz, Deisz, Bergmann, O'Neill, Juarez-Sweeney, Eikenberry

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