Asthma Clinical Care Guideline*

Always check intranet for latest version:** **Posted: 12/18/09

Table of Contents	Target Population	Key Treatment Principles (All treatment recommendations follow NAEPP guidelines unless otherwise specified)
 Key Abbreviations: **NHLBI**- National Heart, Lung, Blood Institute **NAEPP-** National Asthma Education and Prevention Program PAS- Pediatric Asthma Score	**Intended for patients 2 years or older who are being treated for asthma or an asthma exacerbation** **Not intended for patients who** • Are under treatment for bronchiolitis, viral pneumonitis, aspiration pneumonia, or croup • Have Chronic lung disease, BPD, cystic fibrosis, airways anomalies(e.g. tracheomalacia), cardiac disease, or neurologic disorders	• Diagnosis of asthma • Classification of disease severity/level of control for all patients treated for asthma • Treatment of asthma exacerbations in the hospital require Inhaled Beta-2 agonist for symptoms of airway obstruction and Systemic steroids for asthma exacerbations • Asthma exacerbation treatment will follow an algorithm based upon the Clinical assessment score (Pediatric Asthma Score) for ED and inpatients • Controller medication are indicated for persistent • Asthma Education and individualized Asthma Action Plan for all.

Clinical Management

Clinical Management: Diagnosing asthma

1. **Suspect asthma** in any child with episodic symptoms of airflow obstruction (cough, wheeze, shortness of breath) that is at least partially reversible with a bronchodilator
2. **As much as possible, rule out other causes of airway obstruction** such as cystic fibrosis, recurrent aspiration, airway anomalies such as tracheomalacia), GERD, sinusitis, and foreign body aspiration

Clinical Management: Asthma severity assessment

1. **Intermittent vs. Persistent asthma:** Persistent asthma is diagnosed if the child has symptoms more than twice per week during the day or twice per month at night or any exercise limitation or FEV1 less than 80% predicted for children over 5 years.
2. **Treat Persistent asthma** with a daily controller medication such as inhaled corticosteroids (see outpatient guidelines).

(Please see the attached outpatient asthma management guidelines from the Colorado Clinical Guidelines Collaborative for further detail)

Clinical Management: Managing Exacerbations

1. **Telephone Triage (from NHLBI 2007)**
   - **Mild→PCP contact AND short acting bronchodilator every 4 hours:** Dyspnea with activities and/or peak flow > 70% of personal best
   - **Moderate→Same day clinic visit AND short acting bronchodilator every 4 hours AND consider home prednisone:** Dyspnea interfering with activities and peak flow 40-70% of personal best
   - **Severe→ED visit AND repeat short acting bronchodilator every 20 minutes up to 3 doses:** Dyspnea interfering with speech and peak flow 40-70% of personal best
   - **Life Threatening→Activate EMS:** Severe difficulty breathing, not able to speak, cyanosis, combative, agitated or difficult to arouse

2. **Clinical Assessment of exacerbation severity and baseline asthma:**
   - **Asthma Exacerbation History**:
     - Symptom severity (see telephone triage above)

Strength of Evidence:
A = Objective data (OD) and expert opinion (EO) strongly support; B = OD and EO predominantly support; C = EO supports, but OD lacking or inconclusive

- Frequency of bronchodilator use during this exacerbation and compliance with controller medication
- History of recent ED visit or hospitalization in the last year, ICU admission ever
- Exposure to triggers (allergic or other) or recent URI
- Asthma severity assessment

- **Physical exam**:
  - Evaluate for Cough, wheeze, tachypnea, increased work of breathing, low oxygen saturation
  - **Use PAS Score to guide intervention & response to treatment.** PAS includes the following elements: Respiratory Rate, Oxygen Requirements, Auscultation, Retractions, Dyspnea (See table below)
- **Monitoring**
  - Routine vital signs
  - PAS per Asthma Care Pathway
  - **Continuous pulse oximeter** and CVR monitoring only while on continuous nebulizer
  - **IV access** is only needed in a child who is being admitted to the Intensive Care Unit or who is not tolerating oral corticosteroid therapy
  - **Laboratory and radiologic studies** (to be used only if they change management of care)
    1) **Chest X-Ray**: Consider if high fever, history of choking and/or foreign body aspiration, delayed symptom resolution, persistent asymmetric lung exam NOTE**:** A normal chest exam does not exclude asthma
    2) **Arterial or venous blood gas**: Consider if impending respiratory failure.

3. **Treatment**
   - Therapeutics (See attached figure 5-5 from the NHLBI guidelines for dosing):
     - **Oxygen**: Start supplemental oxygen for any child whose oxygen saturation is less that 90%. Increase as needed.
     - **Short acting beta-agonist:** Used for reversal of bronchospasm. The bronchodilator can be given every 20 minutes up to three times or as a one time dose equivalent to one hour of continuous nebulizer treatment. Ipratropium bromide should be added to the 3 back to back treatments in a moderate to severe asthma exacerbation (see telephone triage for definitions of moderate to severe). Short acting beta agonists should be used in every child admitted to the hospital for asthma. The weaning protocol available for inpatient care is included below.
     - **Systemic Corticosteroids**: Used for anti-inflammatory treatment. Systemic corticosteroids should be used in all children admitted to the hospital for asthma. Steroids are recommended early in the course of an exacerbation for children who do not respond quickly or completely to inhaled beta-agonists. Use early in the course of an exacerbation decreases the risk of hospitalization, decreases the length and severity of the exacerbation, may prevent relapse and repeat visits. Oral corticosteroids have similar bioavailability to parenteral steroids. The 2007 NHLBI guidelines do not endorse doubling inhaled corticosteroid dosing due to studies showing poor response (reference??).
       Contraindications: varicella, varicella exposure, tuberculosis, severe respiratory distress, recent steroid course (within 2 weeks) steroids
   - **Outpatient: see guideline**
   - **Emergency Department**: **See guideline**
   - **Inpatient: See guideline**
     - Systemic corticosteroids are indicated for all inpatients and can be given as a loading dose and then should be should be dosed every 12 hours and maximum dose is 80mg/day
     - Short acting beta agonists for all children admitted to the hospital for asthma: *See Inpatient clinical care guideline/ bronchodilator protocol and orders*
     - Provide Asthma Education throughout stay and an Individualized action plan upon discharge
   - **Emergency treatment for impending respiratory failure**
     - Short acting beta agonists in high dose will be given automatically in the bronchodilator weaning pathway. Other children who need emergent therapy will get similar treatment. Back-to-back treatments cannot be given on the floor.
     - Subcutaneous terbutaline (0.01mg/kg/dose maximum 0.3mg/dose) up to 2 doses can be attempted on the floor while waiting for transfer to a higher level of care. **NOTE:** Subcutaneous terbutaline can used to intensify a patient who is on continuously nebulized albuterol.
     - Noninvasive ventilation (e.g. BiPAP and CPAP) can be used for increased work of breathing and low oxygen saturation as long as the PICU has been consulted and there is not room in the PICU or transfer is delayed. Otherwise its use is limited to the PICU and the emergency department
     - Magnesium (40mg/kg-max 2g) can be given on the floor IV over 30 minutes for children with impending respiratory failure if there is not room in the PICU or transfer is delayed. Otherwise its use is limited to the PICU and the emergency department
   - **Consulting asthma specialists (pulmonary or allergy)**
     - ICU admission for asthma
     - Need for noninvasive ventilation

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- Exacerbation complicated or triggered by complicating illnesses such as allergies
- Need for extensive education
- Questioning the diagnosis of asthma
- Already seen by pulmonary or allergy at Children's or National Jewish

- Also can refer to asthma clinic for all high risk asthma (high risk is defined as 2 or more hospitalizations or ED visits in 12 months or an ICU admission ever)

- **Consult social work in any child/family which has trouble obtaining medications or complying with the recommend therapy for asthma**
- **ICU transfer criteria**
  - Impending respiratory failure
  - Maximum continuous nebulizer doses on the floor are 7.5mg/hour for less than 20kg and 10mg/hour for over 20kg. Consult the ICU and pulmonary if higher doses are needed
  - Theophylline can be started on the floor per TCH formulary only after an ICU and pulmonary consult and only if transfer to ICU is not possible

4. **Discharge criteria**
   - Oxygen saturation greater or equal to 90% on room air
   - PAS less than 7 and stable
   - Asthma education completed and Asthma Action Plan provided and sent to the primary care provider
   - Medications relabeled and script provided including controller medications for persistent asthma
   - Patient observed at least 1-2 hours after last bronchodilator therapy

5. **Follow-up**
   - A call will be made to the PCP to discuss the follow-up plan prior to discharge and recommend follow-up visit with PCP or clinic within 1-3 to the family
   - Recommend follow up with asthma specialist for moderate or severe persistent asthma or for any patient who has been hospitalized.
   - For high risk asthma (High risk= Children admitted to the hospital or who have been in the ED more than twice in a 12 months period): A phone call will be made 2-4 weeks after episode to reinforce education received while at the hospital, to answer any questions, and to offer an appointment in the high risk asthma clinic to any patients who are not already followed by an asthma specialist

Patient and Primary Caregiver Education

- Asthma education will be provided throughout episode of treatment, including PCP and specialist visit, ED and inpatient.
- Asthma action plan is required for all children with a primary diagnosis of asthma discharged from the hospital. The action plan should include controller medications, triggers, and follow up provider and phone number. At any site where EPIC is used, the action plan can be found under Letters.
- Patient and primary caregiver need to demonstrate understanding of signs and symptoms, medication and device use, patient specific asthma triggers, peak flow monitoring and the Asthma Action Plan
- Smoke avoidance and cessation counseling referral will be provided to patients and primary caregivers as indicated

Measures & Targets

NOTE: Use PAS Score to guide intervention & response to treatment

#	MEASURES	TARGET
	Process	
	JC: Short Acting Beta Agonist Use	**100%**
	JC: Systemic Corticosteroid use	**100%**
	JC: ICU admission from inpatient for asthma	**less than 10%**
	Hospitalization from the emergency room	**less than 30 %**
	Individualized Action Plan	**75 %**
	Inhaled anti-inflammatory medications for persistent asthma	**75%**
	Outcome Measures	
	ED Length of stay less than 5 hours	**95%**
	Inpatient length of stay less than 2.5 days	**95%**
	ORYX: Inpt Asthma Readmission Rate (within 7 days)	**less than 5%**
	ORYX: Inpt Asthma Readmission Rate (within 30 days)	**less than 5%**
	ORYX: ED Asthma Readmission Rate (within 30 days)	**Less than 10%**
	Outpatient	
	Asthma severity assessment	**90 %**
	Spirometry (5 years old or greater)	**50 %**
	Anti-inflammatory medications for persistent asthma	**75%**
	Individualized Action Plan	**75 %**

Pediatric Asthma Score (PAS)

Score	1	2	3
Respiratory rate 2-3 years 4-5 years 6-12 years older than 12 years	 34 or less 30 or less 26 or less 23 or less	 35 – 39 31 – 35 27 – 30 24 – 27	 40 or greater 36 or greater 31 or greater 28 or greater
Oxygen requirements	Greater than 90% on room air	85% to 90% on room air	Less than 85% on room air
Auscultation	Normal breath sounds to end-expiratory wheeze only	Expiratory wheezing	Inspiratory and expiratory wheezing to diminished breath sounds
Retractions	Zero to one site	Two sites	Three or more sites

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Dyspnea	Speaks in sentences, coos and babbles	Speaks in partial sentences, short cry	Speaks in single words/short phrases/grunting

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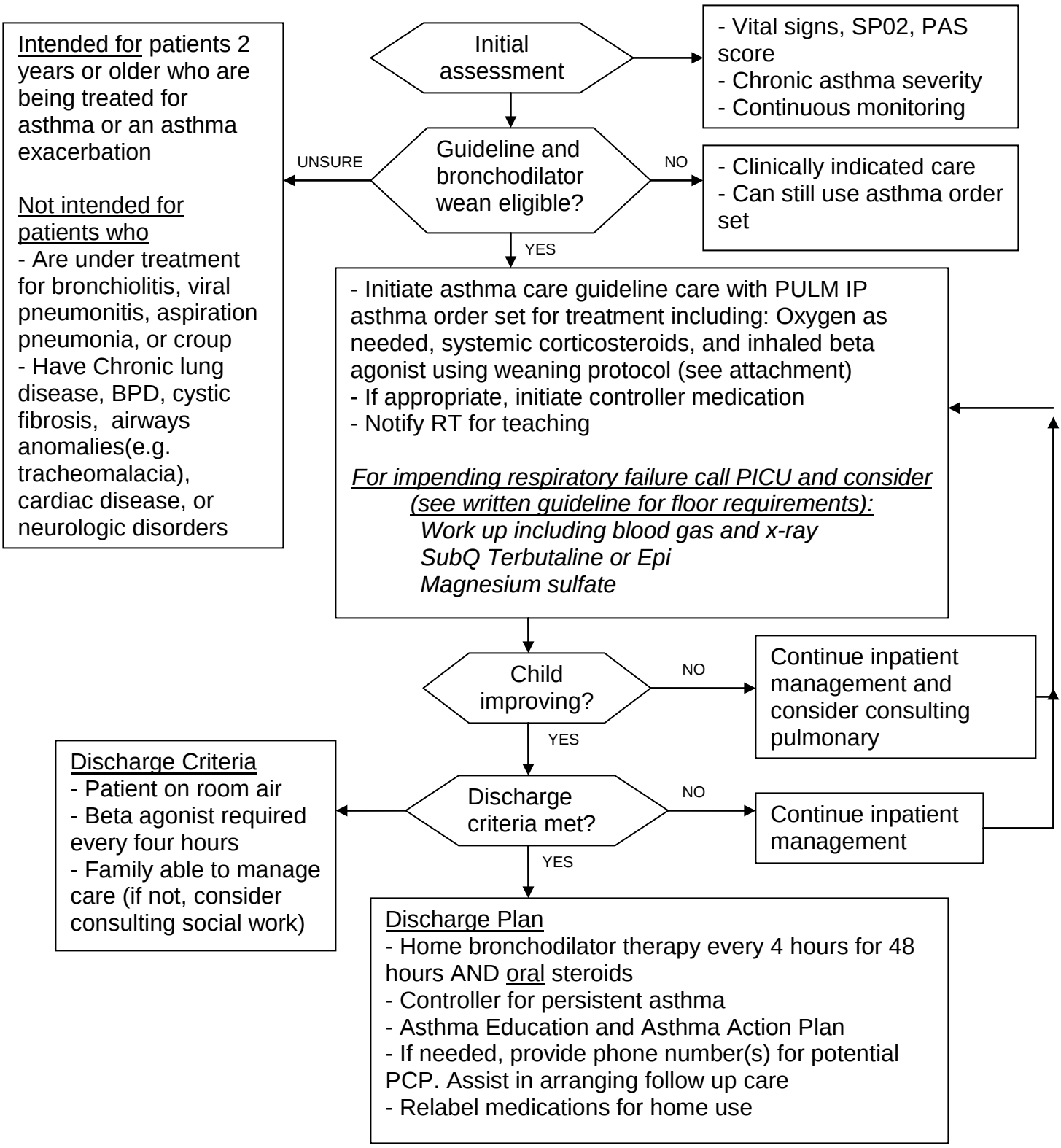
CLINICAL CARE GUIDELINE, ASTHMA: INPATIENT



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CLINICAL CARE GUIDELINE, ASTHMA: EMERGENCY DEPARTMENT

INCLUSION: Children 2 years or older with a history of asthma, albuterol use, or episodic symptoms of airflow obstruction (recurrent cough and/or wheeze), or at least partially reversible, includes first time episode

EXCLUSION: Children less than 2 years old; co-morbid conditions, including but not limited to: chronic lung disease, cystic fibrosis, cardiac disease, bronchiolitis, croup/stridor, aspiration, neurological disorders

Triage RN/Primary RN: Routine Vitals and check saturation, BP and height

Primary RN

1. Initiate Asthma Pathway using ED/Nursing asthma order set and Perform Pediatric Asthma Score (PAS)
2. Oxygen to keep SpO2 greater than 90%
3. Notify respiratory therapy

RT or RN:

1. Give combination Atrovent 0.5 mg nebulized with Albuterol (weight specific dosing below) for a total of up to three initial treatments
2. Repeat PAS after nebs and
3. Prednisone or equivalent 2mg/kg orally with a maximum dose of 80 mg to any child with a PAS score over 7 after the first nebulizer treatment and not contraindicated (See asthma guideline)

Weight	Dose	Frequency
Less than 20 kg	2.5 mg	times 3
20 kg or more	5 mg	times 3

Good Response

- PAS 5-7 within 30 minutes of completing nebs AND SpO2 greater than 90% on room air

- Observe for 60 minutes
- VS (HR, RR, SpO2), PAS in 1 hour
- if PAS 8 or if hypoxic, treat as *""INCOMPLETE RESPONSE"*

Discharge criteria: PAS less than 8 and SpO2 90% or greater on RA

Discharge Plan

- Home bronchodilator therapy every 4 hours for 48 hours
- Prescribe oral steroids for patients receiving 2 or more albuterol treatments and consider if patient has a history of severe asthma exacerbations
- Prescribe Flovent 44 mcg if the patient has one prior ED visit and/or hospitalization within the last 12 months and they are not already on a controller medication
- Asthma Education and Asthma Action Plan
- If needed, provide phone number(s) for potential PCP.
- Relabel beta agonist for home use

Incomplete Response (PAS 8-11) or Poor Response (PAS 12-15) with saturation <90%

- Place on cardio-respiratory monitor with VS (HR,RR,SpO2) every 2 hours
- Albuterol continuous neb with oxygen as needed

Weight	Dose
less than 20kg	7.5mg/hr
20 kg or more	10mg/hr

Recheck in one hour: if PAS is 12 or greater, go to "Poor Response" below. If PAS is less than 12, remove patient from continuous neb for a 30 minute evaluation and:

- If PAS less than 8, go to off continuous
- If PAS is 8 or more put the child back on continuous

Once patient is off continuous:

- Observe for 2 hours
- If PAS is 8 or more, put back on continuous nebs. Retry wean at one hour. Consider admission if wean fails.
- If PAS is less than 8 at 2 hours give 2 puffs Albuterol MDI and wean as tolerated and consider discharge

For patients still on continuous nebs:

- Repeat PAS every hour
- Repeat trial off at one hour if PAS is less than 12 and consider admission
- Go to *"POOR RESPONSE"* if PAS is 12 or greater

Poor Response:

- Consider ABG and CXR Increase Albuterol per ED attending and adjunct therapies such as IV Magnesium, noninvasive ventilation, or subcutaneous terbutaline

Admit Criteria: Unable to wean Albuterol to every 2 hours or SpO2 less than 90% on room air

ICU

-Requires terbutaline infusion, or subcutaneous epinephrine

-Continuous neb requirements below

Weight	Dose
Less than 20kg	More than 7.5mg/hr
20 kg or more	than 10mg/hr

-Change in mental status

-Impending respiratory failure

-Noninvasive Ventilation required

Floor

-Albuterol every 2 hours or stable on cont. albuterol neb for 1 hour

-Continuous neb requirements below

Weight	Dose
Less than 20kg	7.5 mg/hour
20kg or more	10 mg/hour

-Normal mental status

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Asthma Management for Children and Adults

Consider the diagnosis of "asthma" if:

1. *RECURRENT* coughing, wheezing, or shortness of breath relieved by a bronchodilator
2. Objective response by spirometry (≥12% increase of FEV_1 post bronchodilator)
3. Rule out conditions such as aspiration, GERD, airway anomaly, foreign body, cystic fibrosis, vocal cord dysfunction, or COPD. GERD is a common co-morbidity. (If diagnosis in doubt, consult with an asthma specialist.)

Assess Asthma Severity: Persistent vs. Intermittent

Persistent Asthma — any of the following:

1. Symptoms >2 days per week ***OR***
2. Awaken at night from asthma >2X per month ***OR***
3. Limitation of activities, despite pretreatment for exercise induced asthma ***OR***
4. More than 2 steroid bursts in 1 year ***OR***
5. FEV_1 <80% predicted ***OR*** FEV_1/FVC (see below)
6. For children <4 years consider "persistent" if more than 4 episodes of wheezing in a year ***AND*** parental history of asthma or eczema or wheezing between illnesses.

Treatment for Persistent Asthma: Daily Inhaled Corticosteroids

(steps 2, 3 or higher)

Assess Response within 2-6 weeks

"Well Controlled" Asthma

1. Daytime symptoms <2 days per week ***AND***
2. Awakening at night from asthma <2X per month ***AND***
3. No limitation of activities ***AND***
4. Less than 2 steroid bursts per year
5. FEV ≥ 80% predicted
6. FEV_1/FVC →

FEV_1/FVC:
>5 yr 80%
8-19 yr 85%
20-39 yr 80%
40-59 yr 75%
60-80 yr 70%

YES → Follow the **Stepwise Approach Guideline** and consider *step down* if well controlled for 3 consecutive months. Then **re-assess every 3 to 6 months.**

NO → Follow the **Stepwise Approach Guideline** and *step up* until well contolled is achieved. **Re-assess in 2 to 6 weeks.**

Quick Tips for All Patients with Asthma

- ❑ **Environmental Control**: identify and avoid triggers such as tobacco smoke, pollens, molds, animal dander, cockroaches, and dust mites.
- ❑ **Flu Vaccine**: recommend annually.
- ❑ **Spirometry**: at diagnosis and at least annually.
- ❑ **Asthma Score**: use tools such as ACQ®, ACT™ or ATAQ® to assess asthma control.
- ❑ **Asthma Education**: review correct inhaled medication device technique every visit, if needed.
- ❑ **Asthma Action Plan**: at diagnosis; review and update at each visit.
- ❑ **Short-Acting Beta-Agonist** ***(e.g., albuterol)***: 1) quick relief every 4-6 hours, 2) pretreat with 2 puffs for exercise-induced bronchospasm.
- ❑ **Oral Corticosteroids**: consider for acute exacerbation.
- ❑ **Spacer with Valve**: if spacer selected, use spacer with valve.
- ❑ **Mask**: use with spacer with valve and with nebulizer for children <5 years and anyone unable to use correct mouthpiece technique.

See www.coloradoguidelines.org for additional asthma management resources.

Consider referral to a specialist if not well controlled within 3-6 months using stepwise approach ***OR*** 2 or more ED visits or hospitalizations for asthma in a year.

Adapted from the NAEPP 3: http://www.nhlbi.nih.gov/guidelines/asthma/. This guideline is designed to assist the clinician in the management of asthma. This guideline is not intended to replace the clinician's judgment or establish a protocol for all patients with a particular condition. For references, additional copies of the guideline, or patient documents go to www.coloradoguidelines.org or call (720) 297-1681 or 866-401-2092.

Revised 04/08/08

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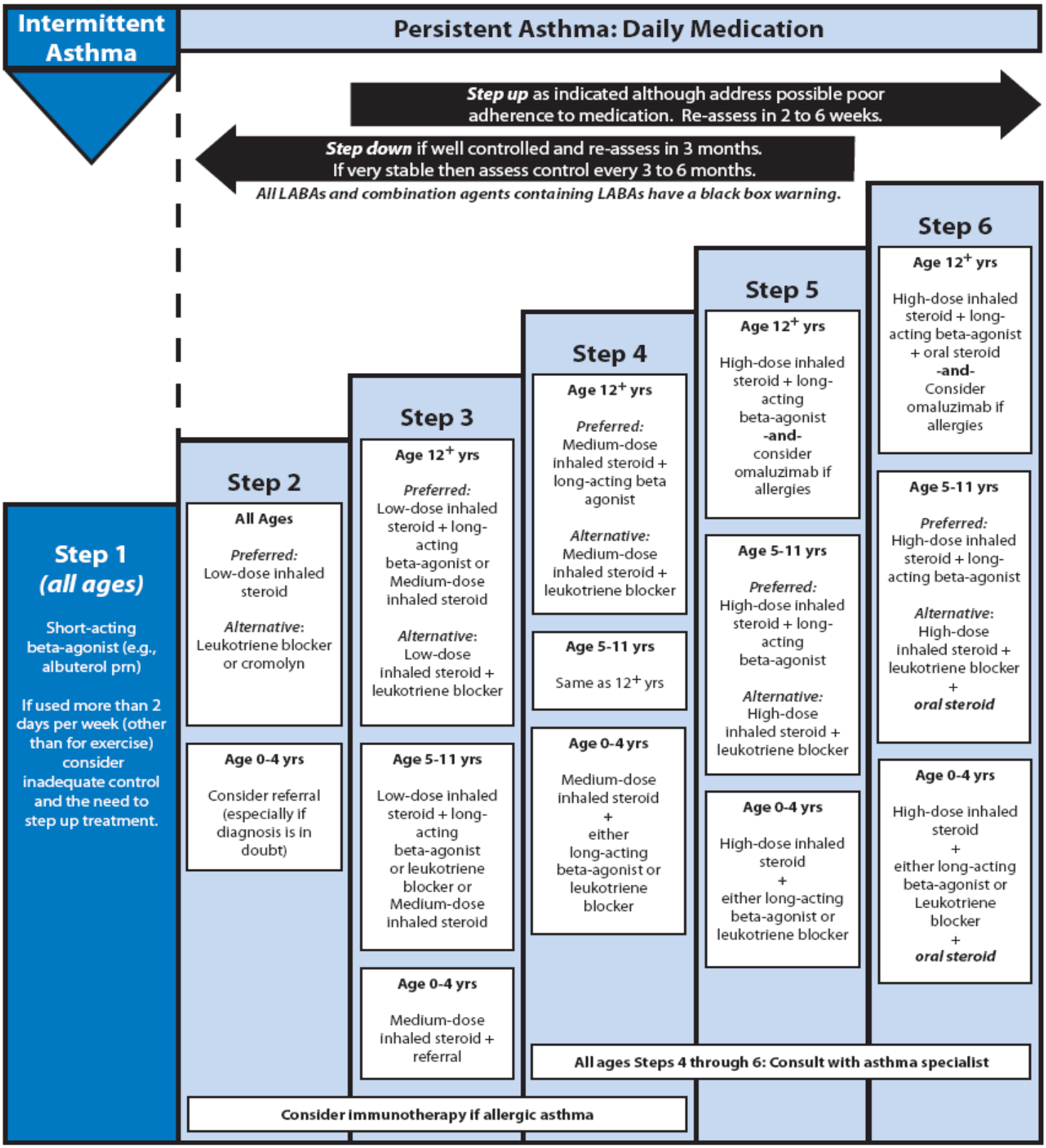
Asthma Stepwise Approach



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Asthma Medications

Inhaled Corticosteroid Controller Medications	FDA approved age (yrs)	*Adult Doses* (Total Daily Inhalations)*		
		Low	Medium	High
Advair® HFA (fluticasone/salmeterol) MDI	12+	(45/21) 4	(115/21) 4	(230/21) 4
Advair® Diskus® (fluticasone/salmeterol) DPI	4+	(100/50) 2	(250/50) 2	(500/50) 2
Aerospan® HFA (flunisolide) 80 mcg MDI	6+	4	4 - 8	> 8
Azmacort® HFA (triamcinolone) 75 mcg MDI	6+	4 - 10	10 - 20	> 20
Asmanex® (mometasone) 220 mcg DPI	12+	1	2	> 2
Asmanex® (mometasone) 110 mcg DPI	4 - 11	n/a	1	n/a
Flovent® HFA (fluticasone) 44 MDI	4+	2 - 6	7 - 10	> 10
Flovent® HFA (fluticasone) 110 MDI	4+	1 - 3	4	> 4
Flovent® HFA (fluticasone) 220 MDI	4+	1	2	> 2
Flovent® Diskus® (fluticasone) 50 DPI	4+	2 - 6	7 - 10	> 10
Pulmicort Flexhaler™ (budesonide) DPI 90 mcg	6+	2 - 6	7 - 13	> 13
Pulmicort Flexhaler™ (budesonide) DPI 180 mcg	6+	1 - 3	4 - 6	> 6
Pulmicort Respules® (budesonide) 0.25, 0.5, or 1 mg	1+	0.5 mg	1 mg	2 mg
Symbicort® 80/4.5 (budesonide/formoterol) MDI	12+	4	4	n/a
Symbicort® 160/4.5 (budesonide/formoterol) MDI	12+	n/a	4	4
QVAR® 40 HFA (beclomethasone) MDI	5+	2 - 6	6 - 12	> 12
QVAR® 80 HFA (beclomethasone) MDI	5+	1 - 3	4 - 6	> 6

***Adult doses listed. Children under 12 years use 60 to 80% of the listed dosages.**
All LABAs and combination agents containing LABAs have a black box warning.
Check product information for dosing frequency.
Key: HFA = hydrofluoroalkane (new propellent); MDI = Metered Dose Inhaler; DPI = Dry Powder Inhaler

Leukotriene Blocker Controller Medications	FDA approved age for asthma	Dosage
Accolate® (zafirlukast) 10 mg tablet	5 - 11 yrs	One tab twice daily
Accolate® (zafirlukast) 20 mg tablet	12+ yrs	One tab twice daily
Singulair® (montelukast) 4 mg granule packet	12 - 23 months	One packet once daily (evening)
Singulair® (montelukast) 4 mg chewable tablet	2 - 5 yrs	One tab once daily (evening)
Singulair® (montelukast) 5 mg chewable tablet	6 - 14 yrs	One tab once daily (evening)
Singulair® (montelukast) 10 mg tablet	15+ yrs	One tab once daily (evening)
Zyflo CR™ (zileutin) 600 mg tablet	12+ yrs	Two tabs two times daily

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FIGURE 5–5. DOSAGES OF DRUGS FOR ASTHMA EXACERBATIONS

Medication	Dosages: Child Dose	Dosages: Adult Dose*	Comments
Inhaled Short-Acting Beta$_2$-Agonists (SABA)			
Albuterol			
Nebulizer solution A. (0.63 mg/3 mL, 1.25 mg/3 mL, 2.5 mg/3 mL, 5.0 mg/mL)	0.15 mg/kg (minimum dose 2.5 mg) every 20 minutes for 3 doses then 0.15–0.3 mg/kg up to 10 mg every 1–4 hours as needed, or 0.5 mg/kg/hour by continuous nebulization.	2.5–5 mg every 20 minutes for 3 doses, then 2.5–10 mg every 1–4 hours as needed, or 10–15 mg/hour continuously.	Only selective beta$_2$-agonists are recommended. For optimal delivery, dilute aerosols to minimum of 3 mL at gas flow of 6–8 L/min. Use large volume nebulizers for continuous administration. May mix with ipratropium nebulizer solution.
MDI B. (90 mcg/puff)	4–8 puffs every 20 minutes for 3 doses, then every 1–4 hours inhalation maneuver as needed. Use VHC; add mask in children <4 years.	4–8 puffs every 20 minutes up to 4 hours, then every 1–4 hours as needed.	In mild-to-moderate exacerbations, MDI plus VHC is as effective as nebulized therapy with appropriate administration technique and coaching by trained personnel.
Bitolterol			
Nebulizer solution C. (2 mg/mL)	See albuterol dose; thought to be half as potent as albuterol on mg basis.	See albuterol dose.	Has not been studied in severe asthma exacerbations. Do not mix with other drugs.
MDI D. (370 mcg/puff)	See albuterol MDI dose.	See albuterol MDI dose.	Has not been studied in severe asthma exacerbations.
Levalbuterol (R-albuterol)			
Nebulizer solution E. (0.63 mg/3 mL, 1.25 mg/0.5 mL 1.25 mg/3 mL)	0.075 mg/kg (minimum dose 1.25 mg) every 20 minutes for 3 doses, then 0.075–0.15 mg/kg up to 5 mg every 1–4 hours as needed.	1.25–2.5 mg every 20 minutes for 3 doses, then 1.25–5 mg every 1–4 hours as needed.	Levalbuterol administered in one-half the mg dose of albuterol provides comparable efficacy and safety. Has not been evaluated by continuous nebulization.
MDI F. (45 mcg/puff)	See albuterol MDI dose.	See albuterol MDI dose.	
Pirbuterol			
MDI G. (200 mcg/puff)	See albuterol MDI dose; thought to be half as potent as albuterol on a mg basis.	See albuterol MDI dose.	Has not been studied in severe asthma exacerbations.
Systemic (Injected) Beta$_2$-Agonists			
Epinephrine H. 1:1,000 (1 mg/mL)	0.01 mg/kg up to 0.3–0.5 mg every 20 minutes for 3 doses sq.	0.3–0.5 mg every 20 minutes for 3 doses sq.	No proven advantage of systemic therapy over aerosol.
Terbutaline I. (1 mg/mL)	0.01 mg/kg every 20 minutes for 3 doses then every 2–6 hours as needed sq.	0.25 mg every 20 minutes for 3 doses sq.	No proven advantage of systemic therapy over aerosol.

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FIGURE 5–5. DOSAGES OF DRUGS FOR ASTHMA EXACERBATIONS (CONTINUED)

Medication	Dosages		
	Child Dose*	Adult Dose	Comments
Anticholinergics			
Ipratropium bromide			
Nebulizer solution J. (0.25 mg/mL)	0.25–0.5 mg every 20 minutes for 3 doses, then as needed	0.5 mg every 20 minutes for 3 doses then as needed	May mix in same nebulizer with albuterol. Should not be used as first-line therapy; should be added to SABA therapy for severe exacerbations. The addition of ipratropium has not been shown to provide further benefit once the patient is hospitalized.
MDI K. (18 mcg/puff)	4–8 puffs every 20 minutes as needed up to 3 hours	8 puffs every 20 minutes as needed up to 3 hours	Should use with VHC and face mask for children <4 years. Studies have examined ipratropium bromide MDI for up to 3 hours.
Ipratropium with albuterol			
Nebulizer solution (Each 3 mL vial contains 0.5 mg ipratropium bromide and 2.5 mg albuterol.)	1.5 mL every 20 minutes for 3 doses, then as needed	3 mL every 20 minutes for 3 doses, then as needed	May be used for up to 3 hours in the initial management of severe exacerbations. The addition of ipratropium to albuterol has not been shown to provide further benefit once the patient is hospitalized.
MDI (Each puff contains 18 mcg ipratropium bromide and 90 mcg of albuterol.)	4–8 puffs every 20 minutes as needed up to 3 hours	8 puffs every 20 minutes as needed up to 3 hours	Should use with VHC and face mask for children <4 years.
Systemic Corticosteroids			
	(Applies to all three corticosteroids)		
Prednisone	1 mg/kg in 2 divided doses (maximum = 60 mg/day) until PEF is 70% of predicted or personal best	40–80 mg/day in 1 or 2 divided doses until PEF reaches 70% of predicted or personal best	For outpatient "burst," use 40–60 mg in single or 2 divided doses for total of 5–10 days in adults (children: 1–2 mg/kg/day maximum 60 mg/day for 3–10 days).
Methylprednisolone			
Prednisolone			

*Children ≤ 12 years of age

Key: ED, emergency department; MDI, metered-dose inhaler; PEF, peak expiratory flow; VHC, valved holding chamber

Notes:

- There is no known advantage for higher doses of corticosteroids in severe asthma exacerbations, nor is there any advantage for intravenous administration over oral therapy provided gastrointestinal transit time or absorption is not impaired.
- The total course of systemic corticosteroids for an asthma exacerbation requiring an ED visit of hospitalization may last from 3 to 10 days. For corticosteroid courses of less than 1 week, there is no need to taper the dose. For slightly longer courses (e.g., up to 10 days), there probably is no need to taper, especially if patients are concurrently taking ICSs.
- ICSs can be started at any point in the treatment of an asthma exacerbation.

Strength of Evidence:
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Attachment: Bronchodilator Weaning Protocol

PHASE 1	PHASE 2	PHASE 3	PHASE 4 Low Dose	INTENSIFICATION
Continuous Nebs: **Albuterol** Weight Dose 20 kg or more: 10 mg/hour less than 20 kg: 7.5 mg/hour **Patients requiring higher doses of continuous albuterol must be transferred to the PICU**	**Albuterol** every 2 hours via MDI/VHC Weight Dose 20 kg or more: 8 puffs Less than 20 kg: 4 puffs -OR- **Albuterol** every 2 hours via neb Weight Dose 20 kg or more: 5 mg less than 20 kg: 2.5 mg	**Albuterol** every 3 hours via MDI/VHC Weight Dose 20 kg or more: 8 puffs Less than 20 kg: 4 puffs -OR- **Albuterol** every 3 hours via neb Weight Dose 20 kg or more: 5 mg Less than 20 kg: 2.5 mg	**Albuterol** every 4 hours via MDI/VHC Weight Dose 20 kg or more: 4 puffs Less than 20 kg: 2 puffs -OR- **Albuterol** 2.5 mg every 4 hours via neb	**Albuterol** via nebulizer times one Weight Dose More than 20kg: 10 mg Less then 20kg: 7.5 mg -OR- Albuterol via MDI/VHC Weight Dose More than 20kg: 10 puffs Less than 20kg: 6 puffs Consider subcutaneous terbutaline 0.01mg/kg up to 0.3mg if intensifying while on continuous
Systemic Corticosteroids delivered every 12 hours at 1/mg/kg up to 80 mg/day. Peak flow per phase or when PAS changes by 2 (children 5 years or older)				
RT/RN evaluate every hour • Pediatric Asthma Score (PAS) • Room air SpO2 • Peak flow	RT/RN evaluate every 2 hours • PAS • RA SpO2 • Peak flow	RT/RN evaluate every 3 hours • PAS • RA SpO2 • Peak flow	RT/RN evaluate every 4 hours: • PAS • RA SpO2 • Peak flow	RT/RN re-evaluate within 1 hour after intensification • PAS • Room air SpO2 • Peak Flow
Inpatient therapist: Initiate education on "what is asthma" , signs and symptoms, and triggers	Inpatient therapist: Initiate education on MDI with VHC use (handout)	Add appropriate controller medications. Initiate education on Peak flow and zones if 5 years or older	Asthma educator: Check understanding of key concepts and device technique, review meds and AAP	

Strength of Evidence:

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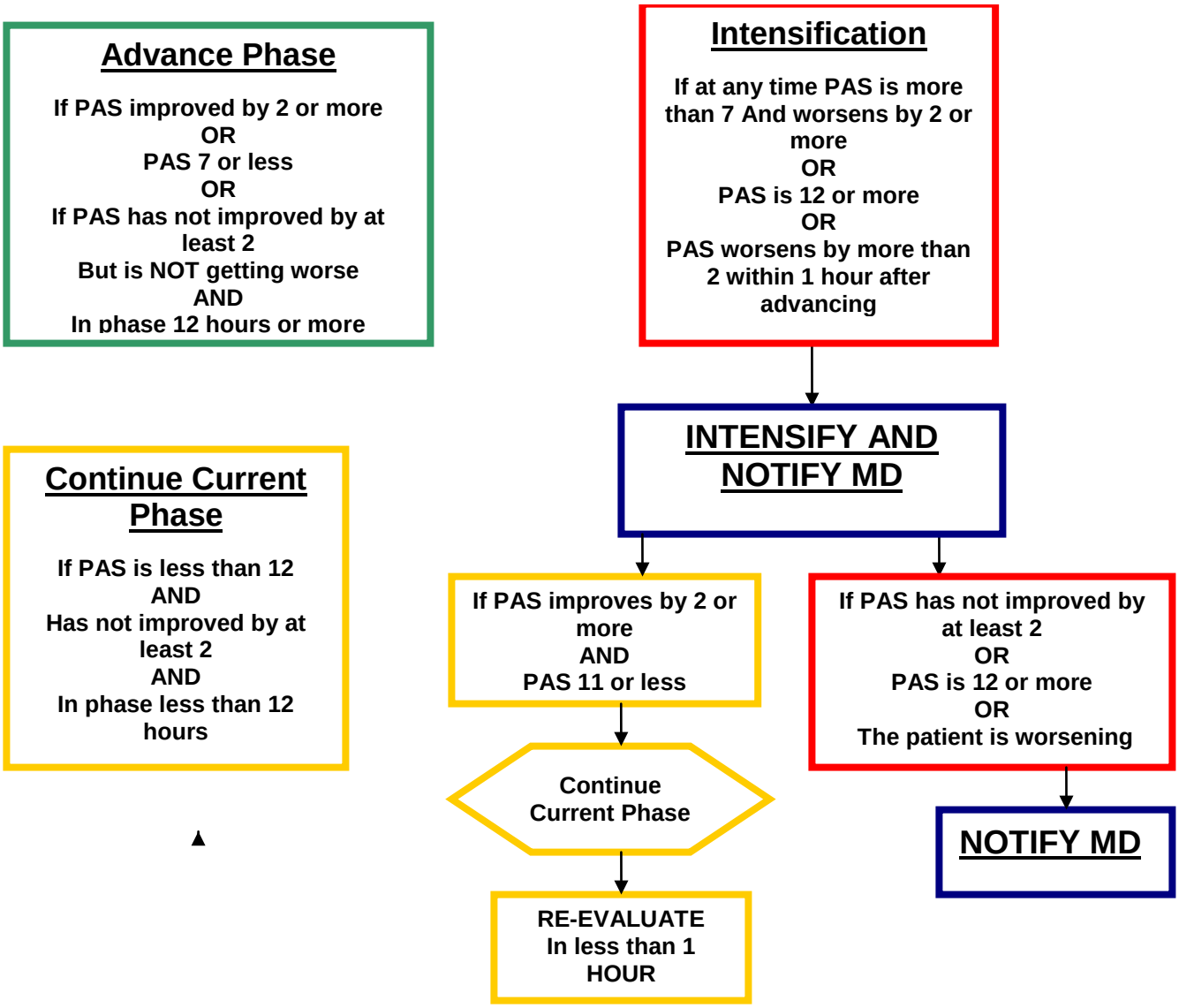
Progression through the bronchodilator weaning protocol



Please note: Clinical care guidelines are designed to assist clinicians and patients make decisions about appropriate health care for specific clinical circumstances. These guidelines should not be considered inclusive of all proper methods of care or exclusive of other methods of care reasonably directed at obtaining the same results. The ultimate judgment regarding care of a particular patient must be made by the clinician in light of the individual circumstances presented by the patient and the needs and resources particular to the locality or institution.

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PARENT EDUCATION MATERIALS

ENGLISH MATERIALS

Asthma Action Plan
http://planettch/patiented/Handouts/PDF/asthmaactionplan-eng-07.pdf

Asthma and the Environment
http://planettch/patiented/Handouts/PDF/asthmaandtheenvironment-eng-05.pdf

Asthma: What is it?
http://planettch/patiented/Handouts/PDF/asthmawhatisit-eng-06.pdf

Diskus
http://planettch/patiented/Handouts/PDF/diskus-eng-04.pdf

Home nebulizer treatments
http://planettch/patiented/Handouts/PDF/homenebulizertreatmt-eng-06.pdf

Metered dose inhaler
http://planettch/patiented/Handouts/PDF/metereddoseinhaleroptichamber-eng-07.pdf

Peak flow meter
http://planettch/patiented/Handouts/PDF/peakflowmeter-eng-05.pdf

Tobacco smoke
http://planettch/patiented/Handouts/PDF/tobaccosmoke-eng-05.pdf

Turbuhaler
http://portal/PATIENTed/Handouts/PDF/Turbuhaler.pdf

SPANISH MATERIALS

Asthma Action Plan
http://planettch/patiented/Handouts/PDF/asthmaactionplan-sp-07.pdf

Asthma and the Environment
http://planettch/patiented/Handouts/PDF/Asthma_and_environment-sp-05.pdf

Asthma: What is it?
http://planettch/patiented/Handouts/PDF/diskus-sp-05.pdf

Diskus
http://planettch/patiented/Handouts/PDF/diskus-sp-09.pdf

Home nebulizer treatments
http://planettch/patiented/Handouts/PDF/homenebulizertreatment-sp-06.pdf

Metered dose inhaler
http://planettch/patiented/Handouts/PDF/metereddoseinhaleroptichamber-sp-07.pdf

Peak flow meter
http://planettch/patiented/Handouts/PDF/peakflowmeter-sp-09.pdf

Tobacco smoke
http://planettch/patiented/Handouts/PDF/tobaccosmoke-sp-05.pdf

Turbuhaler
http://planettch/patiented/Handouts/PDF/turbuhaler-sp-05.pdf

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Evidence Quality C with Recommendation

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