POCKET GUIDE FOR ASTHMA MANAGEMENT AND PREVENTION

(for Adults and Children Older than 5 Years)

A Pocket Guide for Physicians and Nurses

Updated 2010

BASED ON THE GLOBAL STRATEGY FOR ASTHMA MANAGEMENT AND PREVENTION

GLOBAL INITIATIVE FOR ASTHMA

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PREFACE

Asthma is a major cause of chronic morbidity and mortality throughout the world and there is evidence that its prevalence has increased considerably over the past 20 years, especially in children. The **Global Initiative for Asthma** was created to increase awareness of asthma among health professionals, public health authorities, and the general public, and to improve prevention and management through a concerted worldwide effort. The Initiative prepares scientific reports on asthma, encourages dissemination and implementation of the recommendations, and promotes international collaboration on asthma research.

The **Global Initiative for Asthma** offers a framework to achieve and maintain asthma control for most patients that can be adapted to local health care systems and resources. Educational tools, such as laminated cards, or computer-based learning programs can be prepared that are tailored to these systems and resources.

The **Global Initiative for Asthma** program publications include:

- *Global Strategy for Asthma Management and Prevention* (2010). Scientific information and recommendations for asthma programs.
- *Global Strategy for Asthma Management and Prevention* GINA Executive Summary. Eur Respir J 2008; 31: 1-36
- *Pocket Guide for Asthma Management and Prevention for Adults and Children Older Than 5 Years* (2010). Summary of patient care information for primary health care professionals.
- Pocket Guide for Asthma Management and Prevention in Children 5 Years and Younger (2009). Summary of patient care information for pediatricians and other health care professionals.
- *What You and Your Family Can Do About Asthma*. An information booklet for patients and their families.

Publications are available from *www.ginasthma.org*.

This Pocket Guide has been developed from the *Global Strategy for Asthma Management and Prevention* (Updated 2010). Technical discussions of asthma, evidence levels, and specific citations from the scientific literature are included in that source document.

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WHAT IS KNOWN ABOUT ASTHMA?

Unfortunately... asthma is one of the most common chronic diseases, with an estimated 300 million individuals affected worldwide. Its prevalence is increasing, especially among children.

Fortunately... asthma can be effectively treated and most patients can achieve good control of their disease. When asthma is under control patients can:

- ✓ Avoid troublesome symptoms night and day
- ✓ Use little or no reliever medication
- ✓ Have productive, physically active lives
- ✓ Have (near) normal lung function
- ✓ Avoid serious attacks

- Asthma causes recurring episodes of **wheezing, breathlessness, chest tightness,** and **coughing,** particularly at night or in the early morning.

- Asthma is a **chronic inflammatory disorder** of the airways. Chronically inflamed airways are **hyperresponsive;** they become obstructed and airflow is limited (by bronchoconstriction, mucus plugs, and increased inflammation) when airways are exposed to various risk factors.

- Common **risk factors** for asthma symptoms include exposure to allergens (such as those from house dust mites, animals with fur, cockroaches, pollens, and molds), occupational irritants, tobacco smoke, respiratory (viral) infections, exercise, strong emotional expressions, chemical irritants, and drugs (such as aspirin and beta blockers).

- A **stepwise approach** to pharmacologic treatment to achieve and maintain control of asthma should take into account the safety of treatment, potential for adverse effects, and the cost of treatment required to achieve control.

- Asthma **attacks** (or exacerbations) are episodic, but airway inflammation is chronically present.

- For many patients, **controller** medication must be taken daily to prevent symptoms, improve lung function, and prevent attacks. **Reliever** medications may occasionally be required to treat acute symptoms such as wheezing, chest tightness, and cough.

- To reach and maintain asthma control requires the development of a **partnership** between the person with asthma and his or her health care team.

- Asthma is not a cause for shame. Olympic athletes, famous leaders, other celebrities, and ordinary people live **successful lives** with asthma.

DIAGNOSING ASTHMA

Asthma can often be diagnosed on the basis of a patient's **symptoms** and **medical history** (**Figure 1**).

Figure 1. Is It Asthma?

Presence of any of these signs and symptoms should increase the suspicion of asthma:

- Wheezing—high-pitched whistling sounds when breathing out—especially in children. (A normal chest examination does not exclude asthma.)
- History of any of the following:
  - Cough, worse particularly at night
  - Recurrent wheeze
  - Recurrent difficult breathing
  - Recurrent chest tightness
- Symptoms occur or worsen at night, awakening the patient.
- Symptoms occur or worsen in a seasonal pattern.
- The patient also has eczema, hay fever, or a family history of asthma or atopic diseases.
- Symptoms occur or worsen in the presence of:
  - Animals with fur
  - Aerosol chemicals
  - Changes in temperature
  - Domestic dust mites
  - Drugs (aspirin, beta blockers)
  - Exercise
  - Pollen
  - Respiratory (viral) infections
  - Smoke
  - Strong emotional expression
- Symptoms respond to anti-asthma therapy.
- Patient's colds "go to the chest" or take more than 10 days to clear up.

Measurements of **lung function** provide an assessment of the severity, reversibility, and variability of airflow limitation, and help confirm the diagnosis of asthma.

Spirometry is the preferred method of measuring airflow limitation and its reversibility to establish a diagnosis of asthma.

- An increase in FEV_1 of $\geq$ 12% and $\geq$200 ml after administration of a bronchodilator indicates reversible airflow limitation consistent with asthma. (However, most asthma patients will not exhibit reversibility at each assessment, and repeated testing is advised.)

Peak expiratory flow (PEF) measurements can be an important aid in both diagnosis and monitoring of asthma.

- PEF measurements are ideally compared to the patient's own previous best measurements using his/her own peak flow meter.
- An improvement of 60 L/min (or ≥ 20% of the pre-bronchodilator PEF) after inhalation of a bronchodilator, or diurnal variation in PEF of more than 20% (with twice-daily readings, more than 10%), suggests a diagnosis of asthma.

Additional diagnostic tests:

- For patients with symptoms consistent with asthma, but normal lung function, measurements of **airway responsiveness** to methacholine and histamine, an indirect challenge test such as inhaled mannitol, or exercise challenge may help establish a diagnosis of asthma.
- **Skin tests with allergens or measurement of specific IgE in serum:** The presence of allergies increases the probability of a diagnosis of asthma, and can help to identify risk factors that cause asthma symptoms in individual patients.

Diagnostic Challenges

- **Cough-variant asthma.** Some patients with asthma have chronic cough (frequently occurring at night) as their principal, if not only, symptom. For these patients, documentation of lung function variability and airway hyperresponsiveness are particularly important.
- **Exercise-induced bronchoconstriction.** Physical activity is an important cause of asthma symptoms for most asthma patients, and for some (including many children) it is the only cause. Exercise testing with an 8-minute running protocol can establish a firm diagnosis of asthma.
- **Children 5 Years and Younger.** Not all young children who wheeze have asthma. In this age group, the diagnosis of asthma must be based largely on clinical judgment, and should be periodically reviewed as the child grows (see the GINA *Pocket Guide for Asthma Management and Prevention in Children 5 Years and Younger* for further details).
- **Asthma in the elderly.** Diagnosis and treatment of asthma in the elderly are complicated by several factors, including poor perception of symptoms, acceptance of dyspnea as being "normal" for old age, and reduced expectations of mobility and activity. Distinguishing asthma from COPD is particularly difficult, and may require a trial of treatment.
- **Occupational asthma.** Asthma acquired in the workplace is a diagnosis that is frequently missed. The diagnosis requires a defined history of occupational exposure to sensitizing agents; an absence of asthma symptoms before beginning employment; and a documented relationship between symptoms and the workplace (improvement in symptoms away from work and worsening of symptoms upon returning to work).

CLASSIFICATION OF ASTHMA BY LEVEL OF CONTROL

The goal of asthma care is to achieve and maintain control of the clinical manifestations of the disease for prolonged periods. When asthma is controlled, patients can prevent most attacks, avoid troublesome symptoms day and night, and keep physically active.

The assessment of asthma control should include control of the clinical manifestations and control of the expected future risk to the patient such as exacerbations, accelerated decline in lung function, and side-effects of treatment. In general, the achievement of good clinical control of asthma leads to reduced risk of exacerbations.

Figure 2 describes the clinical characteristics of controlled, partly controlled, and uncontrolled asthma.

Figure 2. LEVELS OF ASTHMA CONTROL

A. Assessment of current clinical control (preferably over 4 weeks)

Characteristic	Controlled (All of the following)	Partly Controlled (Any measure present)	Uncontrolled
Daytime symptoms	None (twice or less/week)	More than twice/week	Three or more features of partly controlled asthma*†
Limitation of activities	None	Any	
Nocturnal symptoms/awakening	None	Any	
Need for reliever/ rescue treatment	None (twice or less/week)	More than twice/week	
Lung function (PEF or FEV_1)‡	Normal	<80% predicted or personal best (if known)	

B. Assessment of Future Risk (risk of exacerbations, instability, rapid decline in lung function, side-effects)

Features that are associated with increased risk of adverse events in the future include:

Poor clinical control, frequent exacerbations in past year*, ever admission to critical care for asthma, low FEV_1, exposure to cigarette smoke, high dose medications

* Any exacerbation should prompt review of maintenance treatment to ensure that it is adequate
† By definition, an exacerbation in any week makes that an uncontrolled asthma week
‡ Without administration of bronchodilator, lung function is not a reliable test for children 5 years and younger

Examples of validated measures for assessing clinical control of asthma include:

- Asthma Control Test (ACT): www.asthmacontrol.com
- Childhood Asthma Control test (C-Act)
- Asthma Control Questionnaire (ACQ): www.qoltech.co.uk/Asthma1.htm
- Asthma Therapy Assessment Questionnaire (ATAQ): www.ataqinstrument.com
- Asthma Control Scoring System

FOUR COMPONENTS OF ASTHMA CARE

Four interrelated components of therapy are required to achieve and maintain control of asthma

Component 1. Develop patient/doctor partnership
Component 2. Identify and reduce exposure to risk factors
Component 3. Assess, treat, and monitor asthma
Component 4. Manage asthma exacerbations

Component 1: Develop Patient/Doctor Partnership

The effective management of asthma requires the development of a partnership between the person with asthma and his or her health care team.

With your help, and the help of others on the health care team, patients can learn to:

- Avoid risk factors
- Take medications correctly
- Understand the difference between "controller" and "reliever" medications
- Monitor their status using symptoms and, if relevant, PEF
- Recognize signs that asthma is worsening and take action
- Seek medical help as appropriate

Education should be an integral part of all interactions between health care professionals and patients. Using a variety of methods—such as discussions (with a physician, nurse, outreach worker, counselor, or educator), demonstrations, written materials, group classes, video or audio tapes, dramas, and patient support groups—helps reinforce educational messages.

Working together, you and your patient should prepare a **written personal asthma action plan** that is medically appropriate and practical. A sample asthma plan is shown in **Figure 3**.

Additional self-management plans can be found on several Websites, including:

www.asthma.org.uk
www.nhlbisupport.com/asthma/index.html
www.asthmanz.co.nz

Figure 3. Example of Contents of an Action Plan to Maintain Asthma Control

Your Regular Treatment:

1. **Each day take _____**
2. **Before exercise, take _____**

WHEN TO INCREASE TREATMENT

Assess your level of Asthma Control

In the past week have you had:

Daytime asthma symptoms more than 2 times?	**No**	**Yes**
Activity or exercise limited by asthma?	**No**	**Yes**
Waking at night because of asthma?	**No**	**Yes**
The need to use your [rescue medication] more than 2 times?	**No**	**Yes**
If you are monitoring peak flow, peak flow less than_____?	**No**	**Yes**

If you answered YES to three or more of these questions, your asthma is uncontrolled and you may need to step up your treatment.

HOW TO INCREASE TREATMENT

STEP UP your treatment as follows and assess improvement every day:
_____ [Write in next treatment step here]
Maintain this treatment for _____ days [specify number]

WHEN TO CALL THE DOCTOR/CLINIC.

Call your doctor/clinic: _____ [provide phone numbers]
If you don't respond in _____ days [specify number]
_____ [optional lines for additional instruction]

EMERGENCY/SEVERE LOSS OF CONTROL

- ✓ **If you have severe shortness of breath, and can only speak in short sentences,**
- ✓ **If you are having a severe attack of asthma and are frightened,**
- ✓ **If you need your reliever medication more than every 4 hours and are not improving.**

1. **Take 2 to 4 puffs _____ [reliever medication]**
2. **Take ___ mg of _____ [oral glucocorticosteroid]**
3. **Seek medical help: Go to _____; Address_____ Phone: _____**
4. **Continue to use your _____ [reliever medication] until you are able to get medical help.**

Component 2: Identify and Reduce Exposure to Risk Factors

To improve control of asthma and reduce medication needs, patients should take steps to avoid the risk factors that cause their asthma symptoms (**Figure 4**). However, many asthma patients react to multiple factors that are ubiquitous in the environment, and avoiding some of these factors completely is nearly impossible. Thus, medications to maintain asthma control have an important role because patients are often less sensitive to these risk factors when their asthma is under control.

Physical activity is a common cause of asthma symptoms but patients **should not avoid exercise.** Symptoms can be prevented by taking a rapid-acting inhaled β_2-agonist before strenuous exercise (a leukotriene modifier or cromone are alternatives).

Patients with moderate to severe asthma should be advised to receive an **influenza vaccination** every year, or at least when vaccination of the general population is advised. Inactivated influenza vaccines are safe for adults and children over age 3.

Figure 4. Strategies for Avoiding Common Allergens and Pollutants

Avoidance measures that improve control of asthma and reduce medication needs:

- **Tobacco smoke:** Stay away from tobacco smoke. Patients and parents should not smoke.
- **Drugs, foods, and additives:** Avoid if they are known to cause symptoms.
- **Occupational sensitizers:** Reduce or, preferably, avoid exposure to these agents.

Reasonable avoidance measures that can be recommended but have not been shown to have clinical benefit:

- **House dust mites:** Wash bed linens and blankets weekly in hot water and dry in a hot dryer or the sun. Encase pillows and mattresses in air-tight covers. Replace carpets with hard flooring, especially in sleeping rooms. (If possible, use vacuum cleaner with filters. Use acaricides or tannic acid to kill mites—but make sure the patient is not at home when the treatment occurs.)
- **Animals with fur:** Use air filters. (Remove animals from the home, or at least from the sleeping area. Wash the pet.)
- **Cockroaches:** Clean the home thoroughly and often. Use pesticide spray—but make sure the patient is not at home when spraying occurs.
- **Outdoor pollens and mold:** Close windows and doors and remain indoors when pollen and mold counts are highest.
- **Indoor mold:** Reduce dampness in the home; clean any damp areas frequently.

Component 3: Assess, Treat, and Monitor Asthma

The goal of asthma treatment—to achieve and maintain clinical control—can be reached in most patients through a continuous cycle that involves

- Assessing Asthma Control
- Treating to Achieve Control
- Monitoring to Maintain Control

Assessing Asthma Control

Each patient should be assessed to establish his or her current treatment regimen, adherence to the current regimen, and level of asthma control. A simplified scheme for recognizing controlled, partly controlled, and uncontrolled asthma is provided in **Figure 2**.

Treating to Achieve Control

Each patient is assigned to one of five treatment "steps." **Figure 5** details the treatments at each step for adults and children age 5 and over.

At each treatment step, **reliever medication** should be provided for quick relief of symptoms as needed. (However, be aware of how much reliever medication the patient is using—regular or increased use indicates that asthma is not well controlled.)

At Steps 2 through 5, patients also require one or more regular **controller medications,** which keep symptoms and attacks from starting. Inhaled glucocorticosteroids (**Figure 6**) are the most effective controller medications currently available.

For most patients newly diagnosed with asthma or not yet on medication, treatment should be started at Step 2 (or if the patient is very symptomatic, at Step 3). If asthma is not controlled on the current treatment regimen, treatment should be stepped up until control is achieved.

Patients who do not reach an acceptable level of control at Step 4 can be considered to have **difficult-to-treat asthma.** In these patients, a compromise may need to be reached focusing on achieving the best level of control feasible—with as little disruption of activities and as few daily symptoms as possible—while minimizing the potential for adverse effects from treatment. Referral to an asthma specialist may be helpful.

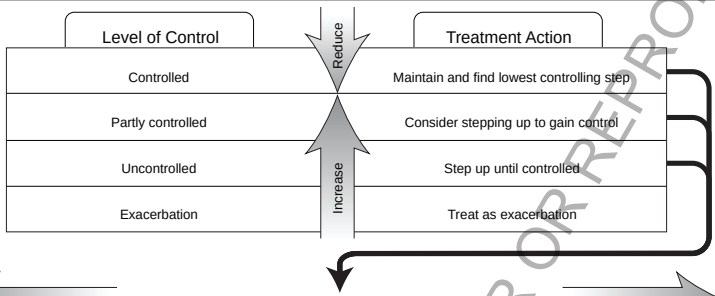
A variety of controller (**Appendix A and Appendix B**) and reliever (**Appendix C**) medications for asthma are available. The recommended treatments are guidelines only. Local resources and individual patient circumstances should determine the specific therapy prescribed for each patient.

Inhaled medications are preferred because they deliver drugs directly to the airways where they are needed, resulting in potent therapeutic effects with fewer systemic side effects. Inhaled medications for asthma are available as pressurized metered-dose inhalers (pMDIs), breath-actuated MDIs, dry powder inhalers (DPIs), and nebulizers. Spacer (or valved holding-chamber) devices make inhalers easier to use and reduce systemic absorption and side effects of inhaled glucocorticosteroids.

Teach patients (and parents) how to use inhaler devices. Different devices need different inhalation techniques.

- Give demonstrations and illustrated instructions.
- Ask patients to show their technique at every visit.
- Information about use of various inhaler devices is found on the GINA Website (*www.ginasthma.org*).

Figure 5. Management Approach Based On Control Adults and Children Older than 5 Years



Asthma education Environmental control				
As needed rapid-acting β_2-agonist	As needed rapid-acting β_2-agonist			
Controller options***	Select one	Select one	To Step 3 treatment, select one or more	To Step 4 treatment, add either
	Low-dose inhaled ICS*	Low-dose ICS plus long-acting β_2-agonist	Medium-or high-dose ICS plus long-acting β_2-agonist	Oral glucocorticosteroid (lowest dose)
	Leukotriene modifier**	Medium-or high-dose ICS	Leukotriene modifier	Anti-IgE treatment
		Low-dose ICS plus leukotriene modifier	Sustained release theophylline	
		Low-dose ICS plus sustained release theophylline		

* ICS = inhaled glucocorticosteroids
**= Receptor antagonist or synthesis inhibitors
*** = Preferred controller options are shown in shaded boxes

Alternative reliever treatments include inhaled anticholinergics, short-acting oral β_2-agonists, some long-acting β_2-agonists, and short-acting theophylline. Regular dosing with short and long-acting β_2-agonist is not advised unless accompanied by regular use of an inhaled glucocorticosteroid.

Figure 6. Estimated Equipotent Daily Doses of Inhaled Glucocorticosteroids for Adults and Children Older than 5 Years†

Drug	Low Dose (μg)†	Medium Daily Dose (μg)†	High Daily Dose (μg)†
Beclomethasone dipropionate	200-500	>500-1000	>1000-2000
Budesonide*	200-400	>400-800	>800-1600
Ciclesonide*	80-160	>160-320	>320-1280
Flunisolide	500-1000	>1000-2000	>2000
Fluticasone propionate	100-250	>250-500	>500-1000
Mometasone furoate*	200	>400	>800
Triamcinolone acetonide	400-1000	>1000-2000	>2000

† Comparisons based upon efficacy data.

‡ Patients considered for high daily doses except for short periods should be referred to a specialist for assessment to consider alternative combinations of controllers. Maximum recommended doses are arbitrary but with prolonged use are associated with increased risk of systemic side effects.

* Approved for once-daily dosing in mild patients.

Notes

- The most important determinant of appropriate dosing is the clinician's judgment of the patient's response to therapy. The clinician must monitor the patient's response in terms of clinical control and adjust the dose accordingly. Once control of asthma is achieved, the dose of medication should be carefully titrated to the **minimum** dose required to maintain control, thus reducing the potential for adverse effects.
- Designation of low, medium, and high doses is provided from manufacturers' recommendations where possible. Clear demonstration of dose-response relationships is seldom provided or available. The principle is therefore to establish the minimum effective controlling dose in each patient, as higher doses may not be more effective and are likely to be associated with greater potential for adverse effects.
- As CFC preparations are taken from the market, medication inserts for HFA preparations should be carefully reviewed by the clinician for the equivalent correct dosage.

Monitoring to Maintain Control

Ongoing monitoring is essential to maintain control and establish the lowest step and dose of treatment to minimize cost and maximize safety.

Typically, patients should be seen one to three months after the initial visit, and every three months thereafter. After an exacerbation, follow-up should be offered within two weeks to one month.

At each visit, ask the questions listed in **Figure 7.**

Adjusting medication:

- If asthma is **not controlled** on the current treatment regimen, **step up** treatment. Generally, improvement should be seen within 1 month. But first review the patient's medication technique, compliance, and avoidance of risk factors.
- If asthma is **partly controlled, consider stepping up** treatment, depending on whether more effective options are available, safety and cost of possible treatment options, and the patient's satisfaction with the level of control achieved.
- If **control is maintained** for at least 3 months, **step down** with a gradual, stepwise reduction in treatment. The goal is to decrease treatment to the least medication necessary to maintain control.

Monitoring is still necessary even after control is achieved, as asthma is a variable disease; treatment has to be adjusted periodically in response to loss of control as indicated by worsening symptoms or the development of an exacerbation.

Figure 7. Questions for Monitoring Asthma Care

IS THE ASTHMA MANAGEMENT PLAN MEETING EXPECTED GOALS?	
Ask the patient:	**Action to consider:**
Has your asthma awakened you at night? *Have you needed more reliever medications than usual?* *Have you needed any urgent medical care?* *Has your peak flow been below your personal best?* *Are you participating in your usual physical activities?*	Adjust medications and management plan as needed (step up or step down). But first, compliance should be assessed.
IS THE PATIENT USING INHALERS, SPACER, OR PEAK FLOW METERS CORRECTLY?	
Ask the patient:	**Action to consider:**
Please show me how you take your medicine.	Demonstrate correct technique. Have patient demonstrate back.
IS THE PATIENT TAKING THE MEDICATIONS AND AVOIDING RISK FACTORS ACCORDING TO THE ASTHMA MANAGEMENT PLAN?	
Ask the patient, for example:	**Action to consider:**
So that we may plan therapy, please tell me how often you actually take the medicine. *What problems have you had following the management plan or taking your medication?* *During the last month, have you ever stopped taking your medicine because you were feeling better?*	Adjust plan to be more practical. Problem solve with the patient to overcome barriers to following the plan.
DOES THE PATIENT HAVE ANY CONCERNS?	
Ask the patient:	**Action to consider:**
What concerns might you have about your asthma, medicines, or management plan?	Provide additional education to relieve concerns and discussion to overcome barriers.

Component 4: Manage Exacerbations

Exacerbations of asthma (asthma attacks) are episodes of a progressive increase in shortness of breath, cough, wheezing, or chest tightness, or a combination of these symptoms.

Do not underestimate the severity of an attack; severe asthma attacks may be life threatening. Their treatment requires close supervision.

Patients at high risk of asthma-related death require closer attention and should be encouraged to seek urgent care early in the course of their exacerbations. These patients include those:

- With a history of near-fatal asthma requiring intubation and mechanical ventilation
- Who have had a hospitalization or emergency visit for asthma within the past year
- Who are currently using or have recently stopped using oral glucocorticosteroids
- Who are not currently using inhaled glucocorticosteroids
- Who are overdependent on rapid-acting inhaled β_2-agnoists, especially those who use more than one canister of salbutamol (or equivalent) monthly
- With a history of psychiatric disease or psychosocial problems, including the use of sedatives
- With a history of noncompliance with an asthma medication plan

Patients should immediately seek medical care if:

- The attack is severe (Figure 8):
  - The patient is breathless at rest, is hunched forward, talks in words rather than sentences (infant stops feeding), is agitated, drowsy, or confused, has bradycardia, or has a respiratory rate greater than 30 per minute
  - Wheeze is loud or absent
  - Pulse is greater than 120/min (greater than 160/min for infants)
  - PEF is less than 60 percent of predicted or personal best, even after initial treatment
  - The patient is exhausted

- **The response to the initial bronchodilator treatment is not prompt** and sustained for at least 3 hours
- **There is no improvement within 2 to 6 hours** after oral glucocorticosteroid treatment is started
- **There is further deterioration**

Mild attacks, defined by a reduction in peak flow of less than 20%, nocturnal awakening, and increased use of rapid-acting β_2-agonists, can usually be treated at home if the patient is prepared and has a personal asthma management plan that includes action steps.

Moderate attacks may require, and severe attacks usually require, care in a clinic or hospital.

Asthma attacks require **prompt treatment:**

- Inhaled rapid-acting β_2-agonists in adequate doses are essential. (Begin with 2 to 4 puffs every 20 minutes for the first hour; then mild exacerbations will require 2 to 4 puffs every 3 to 4 hours, and moderate exacerbations 6 to 10 puffs every 1 to 2 hours.)
- Oral glucocorticosteroids (0.5 to 1 mg of prednisolone/kg or equivalent during a 24-hour period) introduced early in the course of a moderate or severe attack help to reverse the inflammation and speed recovery.
- Oxygen is given at health centers or hospitals if the patient is hypoxemic (achieve O2 saturation of 95%).
- Combination β_2-agonist/anticholinergic therapy is associated with lower hospitalization rates and greater improvement in PEF and FEV_1.
- Methylxanthines are not recommended if used in addition to high doses of inhaled β_2-agonists. However, theophylline can be used if inhaled β_2-agonists are not available. If the patient is already taking theophylline on a daily basis, serum concentration should be measured before adding short-acting theophylline.
- Patients with severe asthma exacerbations unresponsive to bronchodilators and systemic glucocorticosteroids, 2 grams of magnesium sulphate IV has been shown to reduce the need for hospitalizations.

Therapies **not recommended** for treating asthma attacks include:

- Sedatives (strictly avoid)
- Mucolytic drugs (may worsen cough)
- Chest physical therapy/physiotherapy (may increase patient discomfort)
- Hydration with large volumes of fluid for adults and older children (may be necessary for younger children and infants)

- Antibiotics (do not treat attacks but are indicated for patients who also have pneumonia or bacterial infection such as sinusitis)
- Epinephrine/adrenaline (may be indicated for acute treatment of anaphylaxis and angioedema but is not indicated for asthma attacks)

Monitor response to treatment:

Evaluate symptoms and, as much as possible, peak flow. In the hospital, also assess oxygen saturation; consider arterial blood gas measurement in patients with suspected hypoventilation, exhaustion, severe distress, or peak flow 30-50 percent predicted.

Follow up:

After the exacerbation is resolved, the factors that precipitated the exacerbation should be identified and strategies for their future avoidance implemented, and the patient's medication plan reviewed.

Figure 8. Severity of Asthma Exacerbations*

Parameter	Mild	Moderate	Severe	Respiratory arrest imminent
Breathless	Walking Can lie down	Talking Infant - softer, shorter cry; difficulty feeding Prefer sitting	At rest Infant stops feeding Hunched forward	
Talks in	Sentences	Phrases	Words	
Alertness	May be agitated	Usually agitated	Usually agitated	Drowsy or confused
Respiratory rate	Increased	Increased	Often > 30/min	
Normal rates of breathing in awake children: ***Age*** — ***Normal rate*** < 2 months — < 60/min 2-12 months — < 50/min 1-5 years — < 40/min 6-8 years — < 30/min				
Accessory muscles and suprasternal retractions	Usually not	Usually	Usually	Paradoxical thoraco-abdominal movement
Wheeze	Moderate, often only and expiratory	Loud	Usually loud	Absence of wheeze
Pulse/min.	< 100	100-120	> 120	Bradycardia
Guide to limits of normal pulse rate in children: Infants — 2-12 months — -Normal rate <160/min Preschool — 1-2 years — -Normal rate <120/min School age — 2-8 years — -Normal rate <110/min				
Pulsus paradoxus	Absent < 10 mm Hg	May be present 10-25 mm Hg	Often present > 25 mm Hg (adult) 20-40 mm Hg (child)	Absence suggests respiratory muscle fatigue
PEF after initial bronchodilator % predicted or % personal best	Over 80%	Approx. 60-80%	< 60% predicted or personal best (< 100 L/min adults) or response lasts < 2 hrs	
PaO_2 (on air)† and/or $paCO_2$†	Normal Test not usually necessary < 45 mm Hg	> 60 mm Hg < 45 mm Hg	< 60 mm Hg Possible cyanosis > 45 mm Hg; Possible respiratory failure (see text)	
SaO_2% (on air)†	> 95%	91-95%	< 90%	
Hypercapnia (hypoventilation) develops more readily in young children than in adults and adolescents.				

*Note: The presence of several parameters, but not necessarily all, indicates the general classification of the exacerbation.
†Note: Kilopascals are also used internationally, conversion would be appropriate in this regard.

SPECIAL CONSIDERATIONS IN MANAGING ASTHMA

- **Pregnancy.** During pregnancy the severity of asthma often changes, and patients may require close follow-up and adjustment of medications. Pregnant patients with asthma should be advised that the greater risk to their baby lies with poorly controlled asthma, and the safety of most modern asthma treatments should be stressed. Acute exacerbations should be treated aggressively to avoid fetal hypoxia.
- **Obesity.** Management of asthma in the obese should be the same as patients with normal weight. Weight loss in the obese patient improves asthma control, lung function and reduces medication needs.
- **Surgery.** Airway hyperresponsiveness, airflow limitation, and mucus hypersecretion predispose patients with asthma to intraoperative and postoperative respiratory complications, particularly with thoracic and upper abdominal surgeries. Lung function should be evaluated several days prior to surgery, and a brief course of glucocorticosteroids prescribed if FEV_1 is less than 80% of the patient's personal best.
- **Rhinitis, Sinusitis, and Nasal Polyps.** Rhinitis and asthma often coexist in the same patient, and treatment of rhinitis may improve asthma symptoms. Both acute and chronic sinusitis can worsen asthma, and should be treated. Nasal polyps are associated with asthma and rhinitis, often with aspirin sensitivity and most frequently in adult patients. They are normally quite responsive to topical glucocorticosteroids.
- **Occupational asthma.** Pharmacologic therapy for occupational asthma is identical to therapy for other forms of asthma, but is not a substitute for adequate avoidance of the relevant exposure. Consultation with a specialist in asthma management or occupational medicine is advisable.
- **Respiratory infections.** Respiratory infections provoke wheezing and increased asthma symptoms in many patients. Treatment of an infectious exacerbation follows the same principles as treatment of other exacerbations.
- **Gastroesophageal reflux.** Gastroesophageal reflux is more common in patients with asthma compared to the general population. However, treatment with proton pump inhibitors, H_2 antagonists or surgery fail to improve asthma control.
- **Aspirin-induced asthma.** Up to 28 percent of adults with asthma, but rarely children, suffer from asthma exacerbations in response to aspirin and other nonsteroidal anti-inflammatory drugs. The diagnosis can only be confirmed by aspirin challenge, which must be conducted in a facility with cardiopulmonary resuscitation capabilities. Complete avoidance of the drugs that cause symptoms is the standard management.
- **Anaphylaxis.** Anaphylaxis is a potentially life-threatening condition that can both mimic and complicate severe asthma. Prompt treatment is crucial and includes oxygen, intramuscular epinephrine, injectable antihistamine, intravenous hydrocortisone, and intravenous fluid.

Appendix A: Glossary of Asthma Medications - Controllers

Name and Also Known As	Usual Doses	Side Effects	Comments
Glucocorticosteroids Adrenocorticoids Corticosteroids Glucocorticoids **Inhaled (ICS):** Beclomethasone Budesonide Ciclesonide Flunisolide Fluticasone Mometasone Triamcinolone **Tablets or syrups:** hydrocortisone methylprednisolone prednisolone prednisone	**Inhaled:** Beginning dose dependent on asthma control then titrated down over 2-3 months to lowest effective dose once control is achieved. **Tablets or syrups:** For daily control use lowest effective dose 5-40 mg of prednisone equivalent in a.m. or qod. For acute attacks 40-60 mg daily in 1 or 2 divided doses for adults or 1-2 mg/kg daily in children.	**Inhaled:** High daily doses may be associated with skin thinning and bruises, and rarely adrenal suppression. Local side effects are hoarseness and oropharyngeal candidiasis. Low to medium doses have produced minor growth delay or suppression (av. 1cm) in children. Attainment of predicted adult height does not appear to be affected. **Tablets or syrups:** Used long term, may lead to osteoporosis, hypertension, diabetes, cataracts, adrenal suppression, growth suppression, obesity, skin thinning or muscle weakness. Consider coexisting conditions that could be worsened by oral glucocorticosteroids, e.g. herpes virus infections, Varicella, tuberculosis, hypertension, diabetes and osteoporosis	**Inhaled:** Potential but small risk of side effects is well balanced by efficacy. Valved holding-chambers with MDIs and mouth washing with DPIs after inhalation decrease oral Candidiasis. Preparations not equivalent on per puff or μg basis. **Tablet or syrup:** Long term use: alternate day a.m. dosing produces less toxicity. Short term: 3-10 day "bursts" are effective for gaining prompt control.
Sodium cromoglycate cromolyn cromones	MDI 2 mg or 5 mg 2-4 inhalations 3-4 times daily. Nebulizer 20 mg 3-4 times daily.	Minimal side effects. Cough may occur upon inhalation.	May take 4-6 weeks to determine maximum effects. Frequent daily dosing required.
Nedocromil cromones	MDI 2 mg/puff 2-4 inhalations 2-4 times daily.	Cough may occur upon inhalation.	Some patients unable to tolerate the taste.
Long-acting β_2-agonists beta-adrenergis sympathomimetics LABAs **Inhaled:** Formoterol (F) Salmeterol (Sm) **Sustained-release Tablets:** Salbutamol (S) Terbutaline (T) Aminophylline methylxanthine xanthine	**Inhaled:** DPI -F: 1 inhalation (12 μg) bid. MDI- F: 2 puffs bid. DPI-Sm: 1 inhalation (50 μg) bid. MDI-Sm: 2 puffs bid. **Tablets:** S: 4 mg q12h. T: 10mg q12h. Starting dose 10 mg/kg/day with usual 800 mg maximum in 1-2 divided doses.	**Inhaled:** fewer, and less significant, side effects than tablets. Have been associated with an increased risk of severe exacerbations and asthma deaths when added to usual therapy. **Tablets:** may cause tachycardia, anxiety, skeletal muscle tremor, headache, hypokalemia. Nausea and vomiting are most common. Serious effects occurring at higher serum concentrations include seizures, tachycardia, and arrhythmias.	**Inhaled:** Salmeterol NOT to be used to treat acute attacks. Should not use as monotherapy for controller therapy. Always use as adjunct to ICS therapy. Formoterol has onset similar to salbutamol and has been used as needed for acute symptoms. **Tablets:** As effective as sustained-release theophylline. No data for use as adjunctive therapy with inhaled glucocorticosteroids. Theophylline level monitoring is often required. Absorption and metabolism may be affected by many factors, including febrile illness.

Table continued...

Appendix A: Glossary of Asthma Medications - Controllers *(continued...)*

Name and Also Known As	Usual Doses	Side Effects	Comments
Antileukotrienes Leukotriene modifiers Montelukast (M) Pranlukast (P) Zafirlukast (Z) Zileuton (Zi)	Adults: M 10mg qhs P 450mg bid Z 20mg bid; Zi 600mg qid. Children: M 5 mg qhs (6-14 y) M 4 mg qhs (2-5 y) Z 10mg bid (7-11 y).	No specific adverse effects to date at recommended doses. Elevation of liver enzymes with Zafirlukast and Zileuton and limited case reports of reversible hepatitis and hyperbilirubinemia with Zileuton and hepatic failure with afirlukast	Antileukotrienes are most effective for patients with mild persistent asthma. They provide additive benefit when added to ICSs though not as effective as inhaled long-acting β_2-agonists.
Immunomodulators Omalizumab Anti-IgE	Adults: Dose administered subcutaneously every 2 or 4 weeks dependent on weight and IgE concentration	Pain and bruising at injection site (5-20%) and very rarely anaphylaxis (0.1%).	Need to be stored under refrigeration 2-8°C and maximum of 150 mg administered per injection site.

Appendix B: Combination Medications For Asthma

Formulation	Inhaler Devices	Doses Available (µg)[1] ICS/LABA	Inhalations/day	Therapeutic Use
Fluticasone propionate/ salmeterol	DPI	100/50[1] 250/50 500/50	1 inhalation x 2	Maintenance
Fluticasone propionate/ salmeterol	pMDI (Suspension)	50/25[1] 125/25 250/25	2 inhalations x 2	Maintenance
Budesonide/ formoterol	DPI	80/4.5[2] 160/4.5 320/9.0	1-2 inhalations x 2	Maintenance and Relief
Budesonide/ formoterol	pMDI (Suspension)	80/4.5[2] 160/4.5	2 inhalations x 2	Maintenance
Beclomethasone/ formoterol	pMDI (Solution)	100/6[3]	1-2 inhalations x 2	Maintenance
Mometasone/ formoterol	pMDI	100/5 200/5	2 inhalations x 2	Maintenance

ICS = inhaled corticosteroid; LABA = long acting β_2-agonist; pMDI = pressurized metered dose inhaler; DPI = dry powder inhaler

New formulations will be reviewed for inclusion in the table as they are approved. Such medications may be brought to the attention of the GINA Science Committee.

[1] Refers to metered dose. For additional information about dosages and products available in specific countries, please consult *www.gsk.com* to find a link to your country website or contact your local company representatives for products approved for use in your country.

[2] Refers to delivered dose. For additional information about dosages and products available in specific countries, please consult *www.astrazeneca.com* to find a link to your country website or contact your local company representatives for products approved for use in your country.

[3] Refers to metered dose. For additional information about dosages and products available in specific countries, please consult *www.chiesigroup.com* to find a link to your country website or contact your local company representatives for products approved for use in your country.

Appendix C: Glossary of Asthma Medications - Relievers

Name and Also Known As	Usual Doses	Side Effects	Comments
Short-acting β_2-agonists Adrenergics β_2-stimulants Sympathomimetics Albuterol/salbutamol Fenoterol Levalbuterol Metaproterenol Pirbuterol Terbutaline	Differences in potency exist but all products are essentially comparable on a per puff basis. For pre symptomatic use and pretreatment before exercise 2 puffs MDI or 1 inhalation DPI. For asthma attacks 4-8 puffs q2-4h, may administer q20min x 3 with medical supervision or the equivalent of 5 mg salbutamol by nebulizer.	**Inhaled:** tachycardia, skeletal muscle tremor, headache, and irritability. At very high dose hyperglycemia, hypokalemia. Systemic administration as **Tablets or Syrup** increases the risk of these side effects.	Drug of choice for acute bronchospasm. Inhaled route has faster onset and is more effective than tablet or syrup. Increasing use, lack of expected effect, or use of > 1 canister a month indicate poor asthma control; adjust long-term therapy accordingly. Use of $\geq$ 2 canisters per month is associated with an increased risk of a severe, life-threatening asthma attack.
Anticholinergics Ipratropium bromide (IB) Oxitropium bromide	IB-MDI 4-6 puffs q6h or q20 min in the emergency department. Nebulizer 500 µg q20min x 3 then q2-4hrs for adults and 250-500 µg for children.	Minimal mouth dryness or bad taste in the mouth.	May provide additive effects to β_2-agonist but has slower onset of action. Is an alternative for patients with intolerance for β_2-agonists.
Short-acting theophylline Aminophylline	7 mg/kg loading dose over 20 min followed by 0.4 mg/kg/hr continuous infusion.	Nausea, vomiting, headache. At higher serum concentrations: seizures, tachycardia, and arrhythmias.	Theophylline level monitoring is required. Obtain serum levels 12 and 24 hours into infusion. Maintain between 10-15 µg/mL.
Epinephrine/ adrenaline injection	1:1000 solution (1mg/mL) .01mg/kg up to 0.3-0.5 mg, can give q20min x 3.	Similar, but more significant effects than selective β_2-agonist. In addition: hypertension, fever, vomiting in children and hallucinations.	In general, not recommended for treating asthma attacks if selective β_2-agonists are available.

NOTES

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