Managing Asthma

in the Caribbean

CARIBBEAN HEALTH RESEARCH COUNCIL

St. Augustine. Trinidad & Tobago

http://www.chrc-caribbean.org

Disclaimer

These are general guidelines only and may not apply in the case of any particular individual patient. They should be applied bearing in mind the local situation. The health care worker should always use his/her clinical judgement and expertise.

Duality of Interest

No duality of interest was identified.

Preface

The aim of the Clinical Guidelines, ***Managing Asthma in the Caribbean***, is to improve the care provided for patients with asthma. This would be accomplished through improved diagnostic and monitoring skills; better and more appropriate use of available medications to alleviate symptoms and control the condition over the long term; and involving the patient and his/her family in managing and preventing the condition.

The Caribbean Health Research Council (CHRC) has been producing Clinical Guidelines for prevalent chronic diseases in the Caribbean since 1995, as it fulfils one of its mandates i.e. to promote evidence based clinical practice in the Caribbean. To date, conditions addressed include Diabetes, Hypertension and Asthma. These Asthma Guidelines are an update of those produced in 1997 by the CHRC (then known as the Commonwealth Caribbean Medical Research Council (CCMRC)) in collaboration with Global Initiative for Asthma (GINA) and other experts from both within and outside the Caribbean. The current, revised guidelines were developed in collaboration with the University of the West Indies, St. Augustine, Trinidad and Tobago and other partners.

As was the case with the other CHRC Clinical Guidelines, ***Managing Asthma in the Caribbean*** was developed to take into account the culture, economic situation and health care systems of the Caribbean while ensuring that international best practices are applied to patient care.

The process for the development of the Guidelines was as follows:

- Expert workshop to review the original Caribbean Asthma Guidelines as well as other critical publications such as the latest GINA Guidelines. Participants included representatives of both public and private sector organizations from 13 Caribbean countries. It was facilitated by CHRC with some support from the Office of Caribbean Program Coordination, Pan American Health Organization.
- Agreement on the necessary changes in content as well as the format to facilitate easier use of the Guidelines.
- Individual specialist teams developed the various sections of the revised Guidelines. Drafts were circulated to team members by round-robin to achieve concord.
- Before the document was finalized, it was disseminated to a wide cross-section of stakeholders for comment, including the Chief Medical Officers from 19 Caribbean countries.
- Comments were incorporated and the Guidelines published

The revised Guidelines have been extensively modified to now comprise 4 sections:

- Core Information Regarding Asthma and its Management
- Asthma In Young Children (<6 years)
- Asthma in Children 6-13 years
- Asthma in the Adult Patient

In each of the above, guidance is given for community, emergency and in-hospital care

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1.1 ASTHMA IN THE CARIBBEAN

Asthma is characterized by paroxysmal or persistent symptoms such as dyspnea, chest tightness, wheezing, sputum production and cough; there is variable airflow limitation and a variable degree of hyper-responsiveness of airways to endogenous or exogenous stimuli [Boulet, 1999].

Asthma is a serious chronic disease and a major public health problem in the Caribbean. Population based surveys of Caribbean adolescents report that over 13% of participants admitted to having a past or present diagnosis of asthma [Tam Tam 1998, Howitt 1998, Monteil 2006, Kahwa 2006]. Surveys of pediatric hospitals' emergency rooms report that as many as 23% of the cases were acute asthmatics [Longsworth 1986]. At the Port-of Spain General Hospital in Trinidad and Tobago, asthma has been reported as accounting for between 8-10% of admissions to the emergency room [Kirsch 1995, Mungrue 1997, Mahabir 1999], while in Barbados 13% [Naidu 2000] has been documented. Such rates mean that there is a high cost to the care of this disease. In Barbados it has been calculated that asthma drug costs in 1997 accounted for 6% of that nation's drug service [Howitt 2000].

Compounding these statistics, the major contributory factors to asthma morbidity and mortality are under-diagnosis and inappropriate or inadequate treatment. For example, a drug utilization review in asthma treatment in three Caribbean countries revealed a gross underutilization of inhaled steroids, which is the preferred treatment for controlling the disease, and the frequent prescription of medications of dubious efficacy [Burnett and Howitt, 1997]. Even when patients had the appropriate medications, they were often not taking it. Naidu reported that 63% of patients with 'preventer' medication were not taking it [2000]. Further in specialty chest clinics as many as 33% of patients were not using their inhalers correctly [Pinto Pereira 2002].

Asthmatic admissions to hospitals are highest in the last quarter of the year but fall to their lowest levels in April [Depradine 1983 and 1995, Monteil 2000, Ivey 2003]. Admission rates are influenced by climatic variables such as relative humidity and wind speed [Depradine1983 and 1995, Ivey 2000] and African dust clouds [Depradine 1983, Gyan 2005].

There is a high prevalence of other allergic diseases in the patients studied, with skin reactivity to at least one allergen in 50 - 81 percent of subjects. Reactivity to house dust mite, especially Dermatophagoides pteronyssinus, occurred most commonly and sensitivity to this mite correlated with high levels of mite proteins in mattress and bedroom dust [Barnes 1992, Knight-Madden 2006].

These have been major advances in our understanding of the pathophysiology of asthma which has led to more effective treatment and management of the condition. It is now accepted that asthma is a long term inflammatory disorder accompanied by exacerbations of coughing, wheezing and difficulty in breathing.

The approach to treatment and long-term management of asthma includes avoidance of common trigger factors and medications for long-term control of the inflammatory response, for relief of asthma symptoms and to improve lung function. This comprehensive approach involves patient education and involvement in monitoring disease activity, avoidance of risk factors and compliance and long-term medication to control the disease.

1.2 DIAGNOSING ASTHMA

Medical History

- Symptoms: Episodic breathlessness, wheezing, cough (especially at nights), and chest tightness.

- Symptoms may occur or worsen at night, awakening the patient.

- Symptoms occur or worsen in the presence of:
  - -Exercise
  - -Viral infection
  - -Animals with fur
  - -Domestic dust mites (in mattresses, pillows upholstered carpets)
  - -Smoke (tobacco, wood)
  - -Pollen
  - -Change in temperature
  - -Strong emotional expression (laughing or crying hard)
  - -Aerosol chemicals

- Reversible and variable airflow limitation—as measured by using a peak expiratory flow (PEF) meter in any of the following ways (refer to section on the peak flow meter on Page 17 for information on its uses and technique):

    - PEF increases more than 15 percent 15 to 20 minutes after inhalation of a short acting beta-2 agonist or
    - PEF varies more than 20 percent from morning measurement upon arising to measurement 12 hours later in patients taking a bronchodilator (more than 10 percent in patients who are not taking a bronchodilator) or
    - PEF decreases more than 15 percent after 6 minutes of running or exercise.

Physical Examination

Questions to consider in the diagnosis of asthma
• Has the patient had an attack or a recurrent attack of wheezing?
• Does the patient have a troublesome cough at night?
• Does the patient wheeze or cough after exercise?
• Does the patient experience wheezing, chest tightness, or cough after exposure to airborne allergens or pollutants?
• Do the patient's colds "go to the chest" or take more than 10 days to clear up?
• Are symptoms improved by appropriate asthma treatment?

N.B. Episodic symptoms after an incidental allergen exposure, seasonal variability of symptoms and a positive family history of asthma and atopic disease are also helpful diagnostic guides.

Because asthma symptoms are variable, the physical examination of the respiratory system may be normal. The most usual abnormal physical finding is wheezing on auscultation, a finding that confirms the presence of airflow limitation. However, in some people with asthma, wheezing may be absent or only detected when the person exhales forcibly, even in the presence of significant airflow limitation.

Occasionally, in severe asthma exacerbations, wheezing may be absent owing to severely reduced airflow and ventilation. However, patients in this state usually have other physical signs reflecting the exacerbation and its severity, such as cyanosis, drowsiness, difficulty in speaking, tachycardia, hyper-inflated chest, use of accessory muscles, and inter-costal recession.

Other clinical signs are only likely to be present if patients are examined during symptomatic periods. Features of hyperinflation result from patients breathing at a higher lung volume in order to increase outward retraction of the airways and maintain the patency of smaller airways (which are narrowed by a combination of airway smooth muscle contraction, edema, and mucus hyper-secretion). The combination of hyperinflation and airflow limitation in an asthma exacerbation markedly increases the work of breathing.

Diagnostic challenges:

1. Young children whose primary symptoms is cough or who wheeze with respiratory infections are often misdiagnosed as having bronchitis or pneumonia (including acute respiratory disease—ARD) and thus ineffectively treated with antibiotics or cough suppressants. Treatment with asthma medication can be beneficial and diagnostic.

2. Asthma should be considered if the patient's colds repeatedly "go to the chest" or take more than 10 days to clear up, or if the patient improves when asthma medication is given.

3. Tobacco smokers and elderly patients frequently suffer from chronic obstructive pulmonary disease with symptoms similar to asthma.

4. Yet they may also have asthma and benefit from treatment. Improvement in PEF after asthma treatment is diagnostic.

5. Workers who are exposed to inhalant chemicals or allergens in the workplace can develop asthma and may be misdiagnosed as having chronic bronchitis or chronic obstructive pulmonary disease. Early recognition (PEF measurements at work and home), strict avoidance of further exposure, and early treatment are essential.

NOTE

Wheeze is NOT equal to Asthma

In children always consider the differential diagnosis of wheeze:

- Bronchiolitis
- Congestive Cardiac Failure
- Tracheomalacia

- Bronchomalacia
- Bronchopulmonary dysplasia
- Bronchopneumonia
- Foreign Body
- Recurrent aspiration
    - ◊ Gastroesophageal reflux
    - ◊ Tetralogy of Fallot
    - ◊ Pharyngeal incoordination
    - ◊ Muscle weakness
- Worms
- Congenital Disorders - webs, cysts, vascular rings, lung disorders
- Immune deficiencies
    - Congenital
    - Acquired: HIV
- Vocal cord paralysis
- Chronic infections
    - TB
    - HIV-Pneumocystis carinii (P jiroveci)
    - Bronchiectasis
- Tumors, Lymph nodes
- Cystic fibrosis
- Disorders of cilia

ALWAYS perform a complete examination to rule out other causes of wheeze. The following signs suggest causes other than asthma.

- Failure to Thrive
- Clubbing
- Cyanosis
- Chest deformity
- Tracheal deviation
- Unilateral wheeze
- Tachycardia
- Hepatomegaly +/- Splenomegaly

Pitfalls In the Diagnosis of Asthma

- Don't assume the diagnosis of asthma correct
- Consider Stridor vs. Wheeze
- Consider other diagnoses, especially if not responding
- Beware a "normal" respiratory rate
- Beware silent chest
- Do not neglect history examination and investigations

1.3 GENERAL ISSUES IN THE MANAGEMENT OF ASTHMA

1.3.1 Overall aims in the management of asthma

New approaches to asthma therapy help patients prevent most attacks; remain free of troublesome night and day symptoms, and keep physically active.
Achieving control of asthma requires:

1. Educating patients and caregivers to manage the condition
2. Identifying and avoiding triggers that make asthma worse
3. Selecting appropriate medications
4. Stopping asthma attacks
5. Monitoring and modifying asthma care for effective long-term control

Asthma is considered to be controlled if the following criteria are met:

- Daytime symptoms: <2 days / week
- Need for short acting beta agonist: < 2 days / week
- Nocturnal symptoms: None
- No emergency visits
- No limitation on activities, including exercise
- No absence from work or school
- PEF variability <15%
- PEF or Forced expiratory volume in one second (FEV1), (if available) ideally 80% of personal best
- Minimal (or no) adverse effects from medicine

1.3.2 Patient Education

There is good to excellent evidence that education is an essential component of asthma therapy. But asthma education should not rely on written or videotape material only. Patient self monitoring may be effective by measurement of peak expiratory flow (PEF). With your help, and the help of others on the health care team, patients can be actively involved in managing their asthma to prevent problems and can live productive, physically active lives.

With your help, asthma patients can learn to:

* Take medications correctly
* Understand the difference between “relievers” and “controllers” medication
* Avoid triggers
* Monitor their status using symptoms and importantly if available, PEF indicators
* Recognize signs that asthma is worsening and take action
* Seek medical help as appropriate.

Working together, you and your patient should prepare a written **asthma management plan** that is not only medically appropriate but also practical.

An **Asthma Management Plan** should cover:

1. **Prevention steps for long term control**

2. **What daily medication to take**

3. **What asthma triggers to avoid**

4. **Action steps to stop attacks**

5. **How to recognize worsening asthma:**

   List indicators such as increasing cough, chest tightness, wheeze, difficult breathing, talking in incomplete phrases/sentences, sleep disturbance, or PEF measurements below personal best despite increased use of medications.

6. **How to treat worsening asthma:**

   List the names and doses of quick-relief bronchodilator medications and when to use them.

7. **How and when to seek medical attention:**
   List indicators such as feeling panicky, an attack with sudden onset, shortness of breath while resting or speaking a few words, PEF readings below a specified level, or a history of severe attacks.

8. **List the name, location and telephone number of the physician's office or clinic.**

Educational methods should be appropriate for your patients. Using a variety of methods helps reinforce your education. These include:

1. Discussion with a physician, nurse, outreach worker, counselor, or educator
2. Demonstrations, written materials, group classes, video audio tapes, drama
3. Patient support groups
4. Ongoing education, presented at every patient visit, is the key to success in all aspects of asthma management.

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 1.**

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

http://www.asthma.org.uk

http://nhlbisupport.com/asthma/index.html

http://www.asthmanz.co.nz

Figure 1.

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 information]

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.

1.3.3 Identifying and Avoiding Triggers

When patients avoid exposure to asthma triggers (allergens and irritants that make their asthma worse), asthma symptoms and attacks can be prevented and medications reduced. Viral infections have been shown to be associated with exacerbations of wheeze in children in Trinidad and Tobago (Mathew 2009). Common triggers are listed in **Table 1**.

When patients reduce exposure to tobacco smoke and indoor allergens, particularly domestic dust mites, they also help other members of their family. The initial development of asthma, especially in infants may be prevented.

Specific immunotherapy, directed at treating underlying allergy to grass and other pollen, domestic mites, animal dander, or *alternaria*, may be considered when avoiding allergens is not possible or appropriate medications fail to control asthma symptoms. Specific immunotherapy should be performed only by trained health professionals.

Patients with new asthma that may be related to their occupation should be adequately investigated and managed.

Table 1.

Common Asthma Triggers and Avoidance Strategies

Common asthma triggers	Avoidance strategies
Domestic dust mite allergens	Wash bed linens and blankets once a week in hot water and dry in a hot dryer or sun. Encase pillows and mattresses in air tight covers. Remove carpets, especially in sleeping rooms. Use vinyl, leather, or plain wooden furniture instead of fabric covered furniture.
Tobacco smoke	Stay away from tobacco smoke. Patients and parents should not smoke.
Allergens from animals with fur	Remove animals from the home, or at least from the sleeping area
Cockroach allergen	Clean the home thoroughly and often; make every effort to reduce the availability of food. Use pesticide spray-but make sure the patient is not at home when spraying occurs. Restrict potential havens by caulking and sealing cracks in the plasterwork and flooring
Outdoor pollens and mold	Close windows and doors and remain indoors when pollen and mold counts are highest.
Physical activity	Do not avoid physical activity. Symptoms can be prevented by taking short- or long- acting inhaled beta-2-agonist or sodium cromoglycate before strenuous exercise.
Medication: avoid or use with caution	Aspirin, non steroidal anti-inflammatory drugs, beta-blockers (oral or intra-ocular (close supervision is essential))
Viral upper respiratory tract infections, influenza.	For the child with recurrent, severe asthma exacerbations related to viral URIs, consider limiting exposure to viral infections. Influenza vaccines for children with persistent asthma (who are not allergic to eggs).
Occupational asthma	Consider this in all adults with new onset asthma e.g. isocyanates, allergens from grain and others.
Emotions	Avoid emotional and psychological stress
Foods	Food allergies (e.g. peanut), food additives

Classification of Asthma by Level of Control

Traditionally, the degree of symptoms, airflow limitation, and lung function variability have allowed asthma to be classified by **severity** (e.g., as Intermittent, Mild Persistent, Moderate Persistent, or Severe Persistent).

However, it is important to recognize that asthma severity involves both the severity of the underlying disease and its responsiveness to treatment. In addition, severity is not an unvarying feature of an individual patient's asthma, but may change over months or years.

Therefore, for ongoing management of asthma, **classification of asthma by level of control** is more relevant and useful (Figure 2).

Figure 2.
Levels of Asthma Control

Characteristic	**Controlled** *(All of the following)*	**Partly controlled** *(Any measure present in any week)*	**Uncontrolled**
Daytime symptoms	None (twice or less/ week)	More than twice/week	Three or more features of partly controlled asthma present in any week
Limitations 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)	
Exacerbations	None	One or more/year*	One in any week†

** 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.

‡ Lung function is not a reliable test for children 5 years and younger.

Taken from Global Initiative for Asthma Guidelines, 2008

1.3.5 Questions for monitoring asthma care

1. Is the asthma management plan meeting expected goals?

Ask the patient:

- Has your asthma awakened you at night?
- Are you participating in your usual physical activities?
- Have you had a need for more quick relief medications than usual?
- Have you needed any urgent medical care?
- Has your peak flow been below your personal best?

Action to consider:

Adjust medications and management plan as needed (step up or step down) after compliance was assessed.

2. Is the patient using inhalers, spacers, or peak flow meters correctly?

Ask the patient: 'Please show me how you take your medication.'

Action to consider:

Demonstrate correct technique then have the patient practice what you have taught them. Give them feedback on their technique.

3. Is the patient taking the medications and avoiding triggers according to the asthma management plan?

Ask the patient, for example:

- So that we may plan your therapy please tell me exactly how often you take your medicine.
- What problems have you had in following the management plan or in taking your medicine?
- In the past month, have you ever stopped taking your medicine because you felt better?

Action to consider:

Adjust the plan to be more practical.

Negotiate with patient to overcome barriers to following the plan.

4. Does the patient have any concerns?

Ask the patient:

- What concerns might you have about asthma, medicines, or the management plan?

Action to consider:

Provide additional education to relieve concern and discussion to overcome barriers.

1.3.6 Reasons For Non-compliance

Medication-related factors

- Misunderstanding the need for both 'controllers' and 'preventers'.
- Impractical regimen
- Difficulty with inhaler device
- Side effects
- Fear of side effects
- Cost of medication
- Dislike of medication
- Distant pharmacies

Non-Medication factors

- Disbelief or denial of cause of symptoms or attacks
- Misunderstanding of management plan
- Inappropriate expectations
- Lack of guidance for self-management
- Dissatisfaction/ Un-discussed fears or concerns
- Poor supervision, training or follow up
- Cultural issues and family Issues
- Occupational issues
- Long waiting times at pharmacies in health centers

1.3.7 Selecting Devices

Devices available to deliver inhaled medication include pressurized metered-dose inhalers (MDI's), breath-actuated metered dose inhalers, dry powder inhalers, and nebulizers.

Spacers

Spacers also reduce systemic absorption and side effects of inhaled corticosteroids.

For each patient, select the most appropriate devices. In general:

- For patients using spacers, the spacer must fit the inhaler.
- Patients of any age over 5 years who have difficulty using pressurized MDI's should use a pressurized MDI with a spacer, a breath –actuated inhaler, a dry powder inhaler, or a nebulizer. Dry powder inhalers require an inspiratory effort that may be difficult during severe attacks.
- Patients who are having severe attacks should use a pressurized MDI with a spacer or a nebulizer. However, the supervised use of MDIs with spacer devices has proved as effective in the emergency setting as nebulizer therapy for both adults [Turner and Patel 1997] and children [Kelly and Murphy 1992, Amirav 1997].
- 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.

Peak flow meters: uses and techniques

- Lung function measurements assess airflow limitation and help diagnose and monitor the course of asthma. Such objective measurements are important because patients and physicians often do not recognize asthma symptoms or their severity. Lung function measurements for asthma management are used in the same manner as blood pressure measurements for diagnosing and monitoring hypertension.
- Peak Flow Meters are portable handheld devices that are used to measure the peak expiratory flow (PEF). PEF is the maximum air flow achieved during a forced expiration. These devices can be used as a non-invasive form of self-monitoring of respiratory status for patients with asthma. They can be used not only in hospital and clinic settings but also in home and office settings to help diagnose asthma, assess its severity and evaluate response to therapy. There are several kinds available (see below) but the technique for use is similar for all:

Technique for use

1. Stand up straight with the head up. Make sure the marker is at zero. Make sure you do not touch the marker while blowing into the mouthpiece.

2. Take a deep breath, place the meter in your mouth, seal your lips around the mouthpiece, and breathe out as hard and fast as possible. Do not put your tongue into the mouthpiece.

3. Record the result on your chart, and return the marker to zero.

4. Repeat twice more. Choose the highest of the three readings.

   PEF is usually measured at least twice daily over a two to three week period. The personal best is the highest PEF measurement achieved when the patient's asthma is under control. After the personal best is established and symptoms are stable, PEF is measured daily. A reading of less than 80% of one's personal best is an alert. More frequent monitoring may be needed for patients whose conditions are severe, poorly controlled, or who have experienced an exacerbation. Long-tern PEF monitoring is useful, along with review of symptoms, for evaluating a patient's response to therapy.

1.3.8 Notes

- Patients and caregivers should start treatment at the step most appropriate to the initial severity of their condition
- Establish control as soon as possible; then decrease treatment to the least medication necessary to maintain control.
- A rescue course of prednisolone may be needed at any time and step.
- Patients and caregivers should avoid or control triggers at each step.
- All therapy must include patient and caregiver education

Part 2:

Management of Asthma in Young Children (<6 years)

2.1 DIAGNOSTIC CHALLENGES

The diagnosis of asthma in children < 6 years presents a difficult problem. The younger the child the greater the likelihood that an alternate diagnosis may explain recurrent wheeze.

2.2 CLINICAL INDEX OF RISK

Major criteria

Parent with asthma
Personal history of eczema
Allergic sensitization to ≥ 1 aeroallergen

Minor criteria

Wheeze apart from colds
Eosinophilia ≥ 4%
Allergic Rhinitis
Allergic sensitization to eggs, milk, peanuts

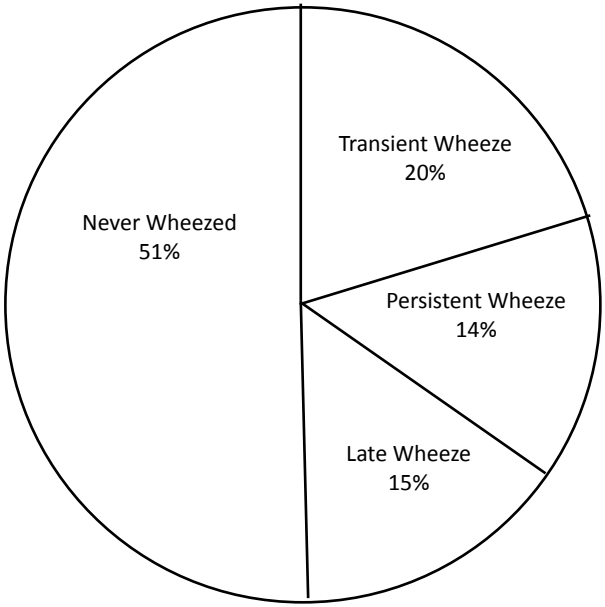
Stringent Index for the prediction of Asthma: Early wheeze greater than 3 times before age 3 years plus 1 major OR 2 minor criteria suggest risk of 4-10 times that of population without wheeze

Loose Index for the prediction of Asthma: Single episode of early wheeze before age 3 years plus 1 major OR 2 minor criteria suggest risk of 3-6 times that of population without wheeze.
95% of children with negative stringent index did not have wheeze at school age.

Of patients who wheeze before age 3 years, wheezing persists through age 6 years in approximately 40 percent. In addition more than half of all cases of persistent asthma start before age 3 years and eighty percent start before age 6 years.

Martinez and colleagues found that of 826 newborns followed from birth to 6 years 51% never wheezed, 20% wheezed by 3 years but had no wheeze at 6 years (transient wheezers) 14% wheezed before 3 years and were still wheezing at 6 years of age (persistent wheezers) and 15% did not wheeze before 3 years but were wheezing at 6 years (late onset wheezers). (Martinez 1995).

Asthma and Wheezing in the first 6 years of life (Tuscon Children's Respiratory Study)



Below are factors associated with transient and persistent wheeze.

Transient wheeze	**Persistent wheeze**
Smaller airway caliber with low lung function at birth	Atopy
No bronchial hyper-responsiveness	Deterioration of lung function by age 6yr
	Bronchial hyper-responsiveness

Prognosis of wheezing in childhood

Sixty percent of children who wheeze before age 3 years stop wheezing by age 6 years. Sixty percent of children who are wheezing at 6 years are not wheezing in adulthood. The most significant risk factor for wheezing in adult hood is wheezing in childhood.

2.3 MANAGEMENT OF THE ACUTE ATTACK

Management of the acute attack in primary care, in the emergency and on the ward is the same as for 6-13 year olds.

2.4 MANAGEMENT APPROACH BASED ON CONTROL

See Figure 2 for assessment of control.

Asthma Education Environmental Control As needed rapid-acting β_2-agonist			
Controlled on needed rapid-acting β_2-agonist	Partly controlled on needed rapid-acting β_2-agonist	Uncontrolled or partly controlled on low dose ICS	Uncontrolled or partly controlled on medium dose ICS
↓	↓ **CONTROLLER OPTIONS** ↓		↓
Step 1	Step 2	Step 3	Step 4-5
As needed rapid-acting β_2-agonist only	Low dose ICS	Double dose of ICS (Medium dose)	Consult with asthma specialist
	Leukotriene modifier	Low dose ICS plus Leukotriene modifier	

ICS = Inhaled corticosteroid

- Control is assessed after resolution of the acute attack.
- Step up if no response in 4-6 weeks. First check inhaler technique, adherence, control of allergic rhinitis and environmental control. Consider possibility of gastro-eosophageal reflux. Consider alternate diagnosis.
- Step down if possible if controlled for at least 3 months.
- Maintain control using the lowest dose of inhaled corticosteroid and/or leukotriene modifier possible

Management of patients who do not have symptoms between attacks

Treat a child with risk factors for persistent asthma (atopy or parental asthma) but without symptoms between attacks as an asthmatic requiring control of asthma if

- Two or more attacks requiring oral steroids occur in 6 months
  OR
- 4 or more wheezing episodes occur in one year

For further details and a guide on managing asthma in children younger than 5 years please refer to GINA 2009 Guidelines *"Global Strategy for the Diagnosis and Management in Children 5 Years and Younger"* and *"Pocket Guide to Asthma Management and Prevention in Children 5 Years and Younger"* www.ginasthma.com.

Part 3:

Management of Asthma in Children 6-13 years

3.1 MANAGEMENT OF ACUTE ASTHMA IN THE PRIMARY CARE SETTING

Basis of Treatment

1. Severity of Symptoms
2. Response to treatment

Management Issues

- Hypoxia
- Bronchospasm
- Inflammation

Assessment of Severity and Treatment

Lower threshold for admission if:

- Attack in late afternoon or night
- Two or more hospitalizations for asthma in the past year
- Previous severe exacerbations requiring ICU admission or intubation.
- Hospital or emergency department visit in the last month
- Concern about social circumstances or ability to cope at home

Table 2:

Management of Acute Asthma in Children

	Mild	Moderate	Severe	Life threatening
Symptoms/Signs	SpO_2 > 95% PEF ≥ 80% Able to talk sentences HR ≤ 100 RR Increased No use of accessory muscles Wheeze end expiratory	SpO_2 > 92% PEF 60-80% Able to talk phrases HR ≤ 120 RR Increased Use of accessory muscles Wheeze expiratory	SpO_2 < 92% PEF < 60% Too breathless to talk HR >120 RR > 30 Use of accessory muscles Wheeze inspiratory and expiratory	SpO_2 < 90% PEF < 33% Poor respiratory effort Bradycardia Agitation Confusion Silent Chest Cyanosis
Treatment	β_2 agonist 2-4 puffs via spacer (Max 3 doses in one hour at 20 minute intervals) Consider oral corticosteroid (OCS) 1-2 mg/kg at least one dose Reassess after each treatment If responding continue β_2 agonist 1-4 hourly If no response arrange transfer to hospital	O_2 to maintain SpO_2 > 95% β_2 agonist 4-10 puffs via spacer or nebulized β_2 agonist 0.03mls/kg (2.5mg-5mg) (Max 3 doses at 20 minute intervals) Consider ipratropium bromide 125-250µg (Max 3 doses in one hour at 20 minute intervals) OCS 2 mg/kg (Max 40mg) Reassess after each treatment If no response arrange transfer to hospital	O_2 to maintain SpO_2 > 95% Nebulized β_2 agonist 0.03mls/kg (2.5mg-5mg) Nebulized ipratropium bromide 125-250µg OCS 2 mg/kg (Max 40mg) Assess response after treatment If poor response transfer to hospital. Maximum of two nebulizations before decision to transfer.	O_2 to maintain SpO_2 > 95% Nebulized β_2 agonist 0.03mls/kg (2.5mg-5mg) Nebulized ipratropium bromide 125-250µg IV hydrocortisone 4-6mg/kg or OCS 2 mg/kg Immediate transfer to hospital

3.2 MANAGEMENT OF ACUTE ASTHMA IN THE EMERGENCY ROOM

Investigations and comments on these are as follows:

Peak flow

- Upon presentation
- At intervals depending on response to therapy
- After first beta2-agonist dose
- After third beta2-agonist dose
- Before discharge

Pulse oximetry

- Reflects PaO_2
- SaO_2 < 91% associated with CO_2 retention

Blood gases

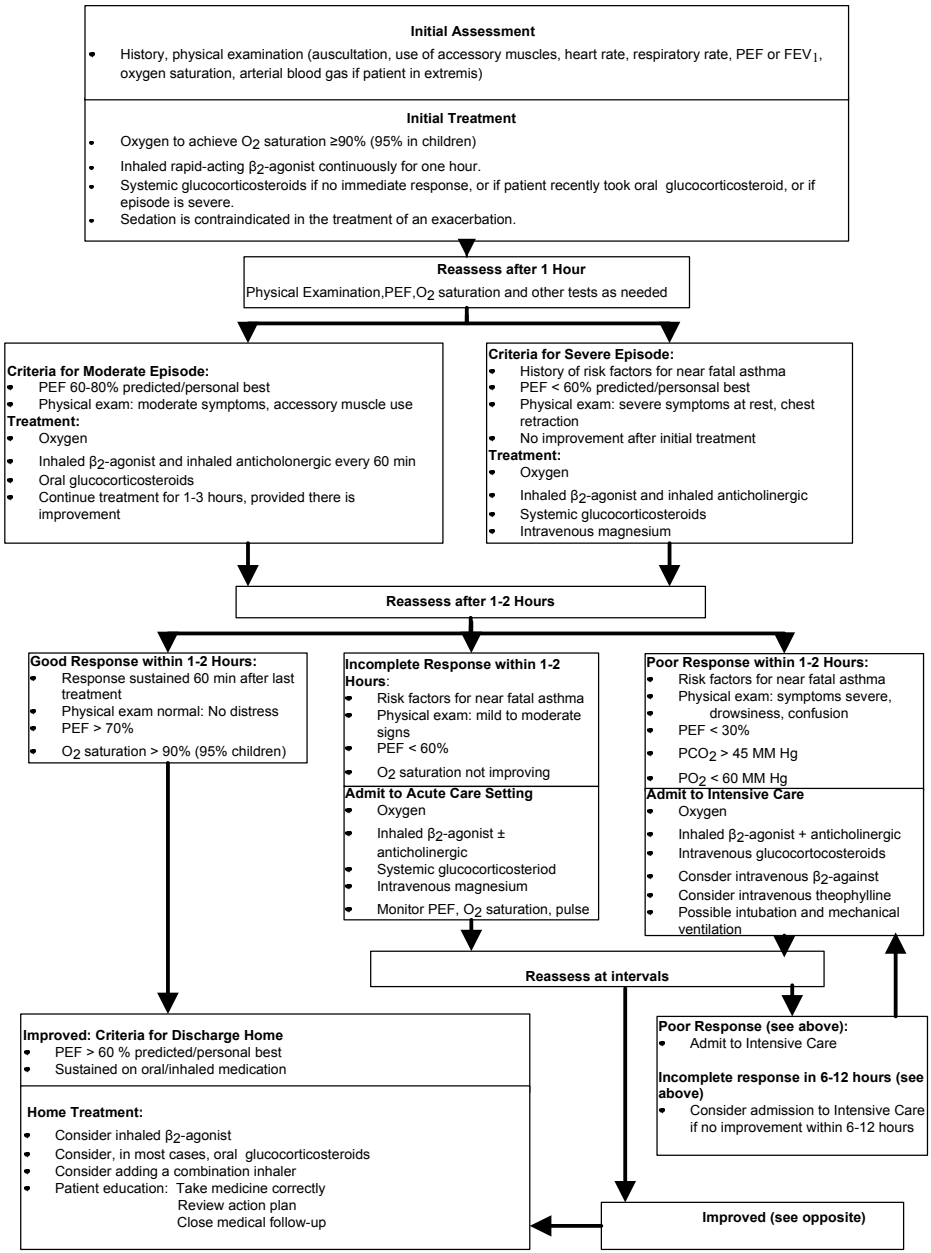
- If SaO_2 < 91 %

Chest X-ray: Look for other causes with similar presentation

- Congenital malformations
- Congestive Cardiac Failure
- Atelectasis
- Pneumonia
- Pneumothorax
- Pneumomediastinum

Figure 3:

Assessment of Severity and Treatment in the A&E



3.3 MANAGEMENT ON THE MEDICAL WARD

Admission Criteria

- Severe life threatening attack
  - Pretreatment SaO_2 < 90%
  - Normal or high CO_2 after treatment
  - Persistent metabolic acidosis
  - Severe obstruction that does not increase by 30-40%
- Patients who fail initial management and/or have an incomplete or poor response after 1-2 hours
- Hospital or emergency department visit within the last month
- Concern about social circumstances or ability to cope at home
- Consider admission in the High Risk Asthmatic i.e. patient with any ONE of the following:
  - Past history of sudden severe exacerbations
  - Prior intubation or admission to ICU for asthma
  - Two or more hospitalizations for asthma in the past year
  - Three or more A&E visits for asthma in the past year
  - Hospitalization or an A&E visit for asthma in the past month
  - Use of >2 canisters per month of inhaled short-acting beta2-agonist
  - Current use of systemic corticosteroids or recent withdrawal from systemic corticosteroids
  - Difficulty perceiving airflow obstruction or its severity
  - Comorbidity, as from cardiovascular diseases or chronic pulmonary disease
  - Serious psychiatric disease or psychosocial problems

Management:

- Continue nebulized β_2 agonist continuously or q1-4 hourly as needed
- Continue ipratropium bromide 125-250-µg q6-8hrly
- Give oxygen to maintain O_2 saturation >95%

- Give IV hydrocortisone for 48 hours or till respiratory distress is improving then give oral prednisone 2 mg/kg to maximum of 40mg for an additional 3-5 days. Prednisone is most effective given three times per day. Continue prednisone for longer if exacerbation is prolonged. No need to wean if total duration less than two weeks.

Admit to ICU if poor response and imminent respiratory failure.

Figure 4:

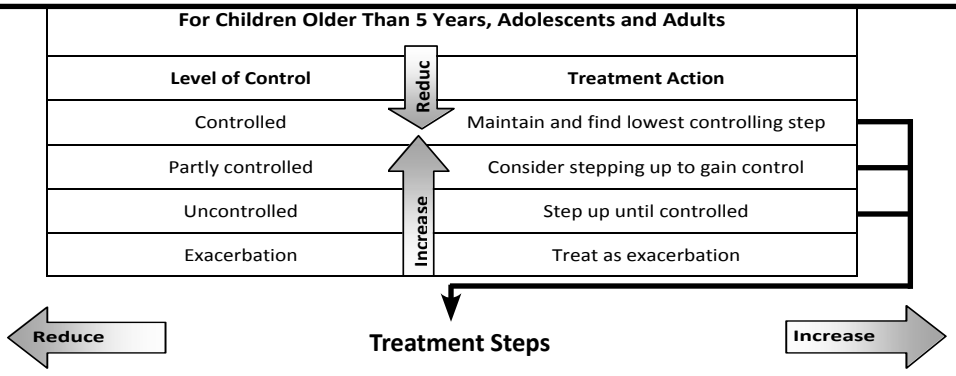
Discharge Criteria

- PEF > 80%
- SaO_2 > 95%
- Minimal/Absent signs and symptoms
- Sufficient medications (bronchodilator and anti-inflammatory) can be obtained
- Outpatient care can be obtained
- Action/Management plan written
- Education re spacer and inhaler devices provided
- Follow up arranged

3.4 MANAGEMENT APPROACH, BASED ON CONTROL

See Figure 2 for assessment of control.

Figure 5:
Management Approach Based on Contol



Step 1	Step 2	Step 3	Step 4	Step 5
Asthma education Environment control				
As needed rapid-acting ß$_2$ agonist	As needed rapid-acting ß$_2$ agonist			
Controller Option ***	Select one	Select one	Add one or more	Add one or both
	Low-dose inhaled ICS*	Low-dose ICS plus long-acting ß$_2$ agonist	Medium-or high-dose ICS plus long-acting ß$_2$ agonist	Oral glucocorticosteroid (lowest dose)
	Leukotriene modifier **	Medium-or high-dose ICS	Leukotriene modifier	Anti-IgE treatment
		Low-dose ICS plus Leukotriene	Sustained release theophylline	
		Low-dose ICS plus sustained release theophylline		

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

Alternative reliever treatments include inhaled anticholinergics, short-acting oral ß$_2$-agonists, some short-acting ß$_2$-agonists, and short-acting theophylline. Regular dosing with short and long-acting ß$_2$-agonist is not advised unless accompanied by regular use of an inhaled glucocorticosteroid.

- Control is assessed after resolution of the acute attack.
  Some patients might not have symptoms between attacks. Patients who have 2 or more exacerbations/year requiring oral steroids are considered to have uncontrolled asthma.

- Step up if no response in 4-6 weeks. First check inhaler technique, adherence, control of allergic rhinitis and environmental control. Consider possibility of gastro-eosophageal reflux. Consider alternate diagnosis.

- Step down if possible if controlled for at least 3 months.

- Consult with asthma specialist at step 4 or higher.

- Maintain control using the lowest dose of inhaled corticosteroid and/or long acting β_2-agonist and/or leukotriene modifier possible.

Figure 6:

Estimated Equipotent Doses of Inhaled Glucocorticosteroids

Drug	Adults Daily dose ((µg)†			Children Daily dose (µg) †		
	Low	Medium	High‡	Low	Medium	High‡
Beclomethasone dipropionate	200-500	>500 -1000	>1000-2000	100-200	>200-400	>400
Budesonide*	200-400	>400-800	>800-1600	100-200	>200-400	>400
Budesonide-Neb	-----	-----	-----	250-500	>500-1000	>1000
Ciclesonide*	80-160	>160-320	>320-1280	80-160	>160-320	>320
Flunisolide	500-1000	>1000-2000	>2000	500-750	>750-1250	>1250
Fluticasone	100-250	>250-500	>500-1000	100-200	>200-500	>500
Mometasone furoate*	200-400	>400-800	>800-1200	100-200	>200-400	>400
Triamcinolone acetonide	400-1000	>1000-2000	>2000	400-800	>800-1200	>1200

† Comparisons based upon efficacy data.

‡ Patients considered for high daily doses except for short periods should be referred to 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.

Additional 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.

Part 4:
Management of Asthma in the Adult

4.1 MANAGEMENT ADULT ASTHMA IN PRIMARY CARE

4.1.1 Assess severity

Cough, breathlessness, wheeze, chest tightness, use of accessory muscles, suprasternal retractions, and sleep disturbances. The PEF is less than 80% of personal best or predicted.

- Inhaled rapid-acting ß$_2$-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 glucocorticosteriods (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 O_2 saturation of 95%).
- Combination ß$_2$-agonists/anticholinergic therapy is associated with lower hospitalization rates and greater improvement in PEF and FEV1.
- Methylxanthines are not recommended if used in addition to high doses of inhaled ß$_2$-agonists. However, theophylline can be used if inhaled ß2-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.

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).

4.1.2 Response to Initial Treatment is….

Good if…. symptoms subside after initial beta 2 agonist and relief is sustained for 4 hours. PEF is greater than 80% of personal best or predicted.

Actions: May continue beta-2 agonist every 3-4 hours for 1-2 days.

Contact physician for follow up instruction.

Incomplete if…symptoms decrease but return in less than 3 hours after initial beta 2 agonist treatment. PEF is 60-80% of personal best or predicted.

Actions: Add corticosteroid tablet or syrup
Continue beta-2 agonist
Consult physician urgently for instructions.

Poor if …Symptoms persist or worsen despite initial beta 2 agonist treatment
Actions: Add corticosteroid tablet or syrup
Repeat beta-2 agonist immediately
Immediate transport to hospital emergency department.

4.1.3 Selecting medications

Environmental control and education should be instituted for all asthma patients.
Two types of medication help control asthma: relievers are medications (short-acting bronchodilators) that work fast to stop attacks or relieve symptoms and controllers are medications (especially anti-inflammatory agents) that keep symptoms and attacks from starting.

Inhaled medications: In the Caribbean tablets and liquids were initially widely used, but **inhaled medications are the most effective treatment today**. High concentrations of drugs are delivered directly to the airways with patent therapeutic effects and minimal side effects.

A stepwise approach is used to classify asthma severity and guide treatment. The number and frequency of medications increase (step up) as the need for asthma therapy increases, and decreases (step down) when asthma is under control.

The recommended treatments are guidelines only. Local resources and individual patient circumstances determine specific therapy. Generic forms of salbutamol have been found to be as effective as branded products in improving pulmonary function but in 1 study, 88% of patients reported throat irritation and cough sensation after inhaling Asthalin (a generic salbutamol). This may reduce patient compliance with treatment (Pinto-Pereira 2002).

Start treatment at the step most appropriate to the initial severity of the patient's asthma. The goal is to establish control as soon as possible; then decrease treatment to the least medication necessary to maintain control.

Persistent asthma is more effectively controlled by long-term treatment to suppress and reverse the inflammation than by only treating acute bronchoconstriction and related symptoms.

Anti-inflammatory agents, particularly inhaled corticosteroids, are currently the most effective long-term preventor medications. Patients who use inhaled glucocorticosteroids regularly should be encouraged to rinse and expectorate to reduce oropharyngeal deposition and systemic absorption.

The initial daily dose of beclomethasone dipropionate or the equivalent is 400-1000 micrograms. Higher doses or oral therapy may be required for more severe asthma.

A short course (7 to 10 days) of oral corticosteroids may be needed at any step to establish prompt control

Step up if control is not achieved. Generally, improvement should be achieved within 1 month. But first review the patient's medication technique, compliance and avoidance of triggers.

Step down if control is sustained for at least 3 months; follow a gradual stepwise reduction in treatment.

Review treatment every 3 to 6 months once asthma is under control.

Consult with an asthma specialist when clinical conditions complicate asthma (e.g., sinusitis), the patient does not respond optimally to therapy, or treatment at step 4 is required.

In patients poorly controlled on continuous steroid use, adding a regular long acting beta agonist improves symptoms and reduces rescue medication use as opposed to increasing the dose of inhaled steroids.

Benefits of low dose inhaled steroid and slow-release theophylline (200mg b.i.d.)

In patients with mild to moderate persistent asthma poorly controlled on inhaled steroids, adding a **slow-release** theophylline 200mg twice a day and continuing the inhaled steroids was better (improved morning and evening PEF) than placebo after 6 months.

In patients with mild to moderate persistent asthma poorly controlled on inhaled steroids, adding a **slow-release** theophylline 200mg twice a day and continuing the inhaled steroids was the same as high dose inhaled steroids (similar morning and evening PEF).

In patients with moderate persistent asthma poorly controlled on budesonide daily > 800 micrograms/day, adding a slow-release theophylline 200mg twice a day and continuing the inhaled steroids gave the same result as either using a leukotriene antagonist or adding a long-acting beta agonist (formoterol) (no significant differences in decrease in daily PEF variability, day or night time asthma symptoms morning and evening PEFR).

For further details of management based on control and doses of inhaled steroids please see figures 5 and 6.

4.2 MANAGEMENT ADULT ASTHMA IN THE EMERGENCY ROOM

4.11 Overview of Acute Care of Asthma in the Adult with Evidence Base

Lessons from studies of asthma deaths and near fatal asthma

Confidential enquires into over 200 asthma deaths in the UK have concluded there are factors associated with the disease, the medical management and the patient's behaviour or psychosocial status which contributed to the death. Most occurred before admission to hospital (Wareham 1993).

Disease factors

Most patients who died of asthma had chronically severe asthma. In a minority the fatal attack occurred suddenly in a patient with only mild or moderately severe background disease. (Wareham 1993, Harrison 2000)

Medical management

Many of the deaths occurred in patients who had received inadequate treatment with inhaled steroid tablets and/or inadequate objective monitoring of their asthma. Follow-up was inadequate in some and others should have been referred earlier for specialist advice. There was widespread under-use of written management plans. Heavy increasing use of beta-2 agonist therapy was associated with asthma death. (Wareham 1993, Spitzer 1992, Suissa 1994)

Deaths have continued to be reported following inappropriate prescription of ß-blocker therapy or heavy sedation. A small proportion of patients with asthma were sensitive to non-steroidal anti-inflammatory agents; all asthma patients should be asked about past reactions to these agents and to be cautious about their use.

Adverse psychosocial and behavioral factors

Behavioral and adverse psychosocial factors were recorded in the majority of patients who died of asthma. (Wareham 1993). The most important are shown in Table 3.

Case control studies support most of these observations (Rea 1986, Jalaludin 1999).

Compared with control patients admitted to hospital with asthma, those who died were significantly more likely to have learning difficulties; psychosis or prescribed antipsychotic drugs; financial or employment of problems; repeatedly failed to attend appointments or discharged themselves from hospital; drug or alcohol abuse; obesity; or a previous near fatal attack.

Compared with control patients with asthma in the community, patients who died had more severe disease; more likelihood of a hospital admission or visit to A&E for their asthma in the previous year; more likelihood of a previous near fatal attack; poor medical management; failure to measure pulmonary function; and non-compliance.

Health care professionals must be aware that patients with severe asthma and one or more adverse psychosocial factors are at risk of death.

Table 3:

Features of Near Fatal Adult Asthma

A COMBINATION OF **SEVERE ASTHMA** RECOGNISED BY ONE OR MORE OF: • previous near fatal asthma, e.g. previous ventilation or respiratory acidosis • previous admission for asthma especially if in the last year • requiring three or more classes of asthma medication • heavy use of $ß_2$ agonist • repeated attendances at A&E for asthma care especially if in the last year • brittle asthma.
AND ADVERSE BEHAVIOURAL OR PSYCHOSOCIAL FEATURES *RECOGNISED BY ONE OR MORE OF*: • **non-compliance with treatment or monitoring** • **failure to attend appointments** • **self -discharge from hospital** • **psychosis, depression, other psychiatric illness or deliberate self-harm** • **current or recent major tranquilliser use** • **denial** • **alcohol or drug abuse** • **obesity** • **learning difficulties** • **employment problems** • **income problems** • **social isolation** • **childhood domestic, marital or legal stress.**

Studies comparing near fatal asthma with deaths from asthma have concluded that patients with near fatal asthma have identical adverse factors to those described in Table 3, and that these contribute to the near fatal asthma attack. (Richards 1993, Innes 1998). Compared with patients who die, those with near fatal asthma are significantly younger, are significantly more likely to have had a previous near fatal asthma attack, are less likely to have concurrent medical conditions, are likely to experience delay in receiving medical care, and more likely to have ready access to acute medical care.

Not all patients with near fatal asthma require intermittent positive pressure ventilation.

For those with near fatal asthma, adults as well as children, it is always wise to involve a close relative when discussing future management.

Patients with brittle asthma should also be identified *(see Table 4)*

> *Where services allow keep patients who have had near fatal asthma or brittle asthma under specialist supervision indefinitely.*

Seasonal factors

In the UK there is a peak of asthma deaths in younger people (aged up to 44 years) in July and August and in December and January in older people. (Campbell 1997, Khot 1983).

Prediction and prevention of a severe asthma attack

Most (88-92%) attacks of asthma severe enough to require hospital admission develop relatively slowly over a period of six hours or more. In one study, over 80% of attacks developed over more than 48 hours. (Kolbe 1998, Kolbe 2000). There should therefore be time for effective action and the potential to reduce the number of attacks requiring hospitalization. There are many similarities between patients who die from asthma, patients with near fatal asthma and asthmatic controls who are admitted to hospital.

> *Where feasible, a respiratory specialist or specialist physician should follow up patients admitted with severe asthma for at least one year after the admission.*

Criteria for referral

Refer to hospital any patients with features of acute severe or life threatening asthma.

Other factors, such as failure to respond to treatment, social circumstances or concomitant disease, may warrant hospital referral.

4.1.2 Initial Assessment and Investigation of Acute Asthma in the Adult

Acute asthma in adults

Recommendations for patients presenting with acute or uncontrolled asthma in primary care are shown elsewhere in this document. We proceed now with care in those seen in the emergency department and on the medical wards.

Recognition of acute asthma

Definitions of increasing levels of severity of acute asthma exacerbations are provided in Table 4. Predicted PEF values (Nunn 1989)) should be used only if the recent best PEF (within two years) is unknown .

Self-treatment by patients developing acute or uncontrolled asthma

Many patients with asthma and all patients with severe asthma should have an agreed written action plan and their own peak flow meter, with regular checks of inhaler technique and compliance. They should know when and how to increase their medication and when to seek medical assistance. Asthma action plans have been shown to decrease hospitalization for and deaths from asthma (Abramson 2001).

Initial assessment

All possible initial contact personnel, e.g. practice receptionists, ambulance call takers, should be aware that asthma patients complaining of respiratory symptoms may be at risk and should have immediate access to a doctor or trained asthma nurse if available. The assessments required to determine whether the patient is suffering from an acute attack of asthma, the severity of the attack and the nature of treatment required are detailed in Tables 4 and 5. It may also be helpful to use a systematic recording process. Proformas have proved useful in the A&E setting (Robinson 1996).

Table 4:

Levels of severity of actue asthma exacerbations in adults

Near fatal asthma	Raised $PaCO_2$ and/or requiring mechanical ventilation with raised inflation pressures (Richards 1993, Innes 1998)
Life threatening asthma	Any one of the following in a patient with severe asthma - PEF <33% best or predicted - SpO_2<92% - PaO_2<8kPa - normal $PaCO_2$(4.6-6.0kPa) - silent chest - cyanosis - feeble respiratory effort - bradycardia - dysrhythmia - hypotension - exhaustion - confusion - coma
Acute severe asthma	Any one of: - PEF 33-50% best or predicted - respiratory rate >25/min - heart rate > 110/min - inability to complete sentences in one breath
Moderate asthma exacerbation	- Increasing symptoms - PEF> 50-75% best or predicted - no features of acute severe asthma
Brittle asthma	- Type l: wide PEF variability (>40% diurnal variation for 50% of the time over a period >150 days) despite intense therapy - Type 2: sudden severe attacks on a background of apparently well controlled asthma

Prevention of acute deterioration

A register of patients at risk may help primary care health professionals to identify patients who are more likely to die from their asthma. Where possible, a system should be in place to ensure that these patients are contacted if they fail to attend for follow up.

Table 5:

Initial assessment - the role of symptoms, signs and measurements in adults

Clinical features	Clinical features, symptoms and respiratory and cardiovascular signs are helpful in recognizing some patients with severe asthma, e.g. severe breathlessness (including too breathless to complete sentences in one breath), tachypnoea, tachycardia, silent chest, cyanosis or collapse. *None of these singly or together is specific and their absence does not exclude a severe attack.*
PEF or FEV	Measurements of airway caliber improve recognition of the degree of severity, the appropriateness or intensity of therapy and decisions about management in hospital or at home. (Shim 1980, Emerman 1995). PEF or FEV, are both useful and valid measures of airway caliber. PEF is more convenient and cheaper. PEF expressed as a percentage of the patient's previous best value is most useful clinically. PEF as a percentage of predicted gives a rough guide in the absence of a known previous best value. Different peak flow meters give different readings. Where possible the same or similar type of peak flow meter should be used. The Nunn& Gregg nomogram is recommended for use with peak flow meter. (Gregg 1973).
Pulse oximetry	Measurement of oxygen saturation (SpO_2) with a pulse oximeter is necessary in acute severe asthma to determine the adequacy of oxygen therapy and the need for arterial blood gas (ABG) measurement. The aim of oxygen therapy is to maintain SpO_2>92%.
Blood gases (ABG)	Patients with SpO_2<92% or other features of life threatening asthma require ABG measurement.
Chest X-ray	Chest x-ray is not routinely recommended in patients in the absence of: - suspended pneumomediastinum or pneumothorax - suspected consolidation - life threatening asthma - failure to respond to treatment - requirement for ventilation.
Systolic paradox	Systolic paradox *(pulsus paradoxus)* has been abandoned as an indicator of the severity of an attack for pragmatic reasons.

4.3 MANAGEMENT OF ADULT ASTHMA ON THE MEDICAL WARD

4.3.1 Criteria for admission to the ward

Admit patients with any feature of a life threatening or near fatal attack

Admit patients with any feature of a severe attack persisting after initial treatment (Wareham 1993, Mohan 1996, Campbell 1997, Innes 1998)

Patients whose peak flow is greater than 75% best or predicted one hour after initial treatment may be discharged from A&E, unless they meet any of the following criteria, when admission may be appropriate:

- Still have significant symptoms
- Concerns about compliance
- Living alone/socially isolated
- Psychological problems
- Physical disability or learning difficulties
- Previous near fatal or brittle asthma
- Exacerbation despite adequate dose steroid tablets pre-presentation
- Presentation at night
- Pregnancy

4.3.2 Treatment of acute asthma in adults (Evidence Base and Recommendations)

A) Oxygen

Patients with acute severe asthma are hypoxaemic (Malfina 1991, Jenkins 1981). This should be corrected urgently using high concentrations of inspired oxygen (usually 40-60%) and a high flow mask (e.g. Hudson mask). Unlike patients with COPD there is little danger of precipitating hypercapnea with high flow oxygen. Hypercapnea indicates the development of near fatal asthma and the need for emergency specialist/ anaesthetic intervention. Oxygen saturations of at least 92% must be achieved.

Give high flow oxygen to all patients with acute severe asthma.

In view of the theoretical risk of oxygen desaturation while using air driven compressors to nebulise β_2 agonist bronchodilators, oxygen-driven nebulisers are the preferred method of delivery in hospitals, ambulances and primary care. (Gleeson, 1998) (NB: In order to generate the flow rate of 61/ min required to drive most nebulisers, a high flow regulator must be fitted at the oxygen cylinder). The absence of supplemental oxygen should not prevent nebulised therapy from being administered where appropriate. (Douglas 1985).

- **In hospital, ambulance and primary care, nebulised β_2 agonist bronchodilators should be driven by oxygen.**
- **Outside hospital, high dose β_2 agonist bronchodilators may be delivered via large volume spacers or nebulisers.**

Whilst supplemental oxygen is recommended, its absence should not prevent nebulised therapy being given if indicated.

B) Beta-2 agonist bronchodilators

In most cases of acute asthma inhaled β_2 agonists given in high doses act quickly to relieve bronchospasm with few side-effects (Sigel 1985). There is no evidence for any difference in efficacy between salbutamol and terbutaline, although rarely patients may express preference.

In acute asthma without life threatening features, β_2 agonists can be administered by repeated activations of a pMDI via an appropriate large volume spacer or via spacer (4 to 6 puffs each inhaled separately; this dose can be repeated at 10-20 minute intervals) or by wet nebulisation driven by oxygen, if available. Inhaled β_2 agonists are at least as efficacious and preferable to intravenous β_2 agonists (meta-analysis has excluded subcutaneous trials) in adult acute asthma in the majority of cases. (Travers 2001).

Use high dose inhaled β_2 agonists as first line agents in acute asthma and administer as early as possible. Intravenous β_2 agonists should be reserved for those patients in whom inhaled therapy cannot be used reliably.

In acute asthma with life threatening features the nebulised route (oxygen-driven) is recommended.

Parenteral β_2 agonists, in addition to inhaled β_2 agonists, may have a role in ventilated patients or those patients *in extremis* in whom nebulised therapy may fail; however there is limited evidence to support this.

Continuous nebulisation of β_2 agonists is at least as efficacious as bolus nebulisation in relieving acute asthma. It is more effective in airflow obstruction that is severe or unresponsive to initial treatment. (Rudinsky 1993). However, most cases of acute asthma will respond adequately to bolus nebulisation of β_2 agonists.

In severe asthma (PEF) <50% best or predicted) and asthma that is poorly responsive to an initial bolus dose of β_2 agonist, consider continuous nebulisation, using an appropriate nebuliser system.

Continuous nebulisation cannot be achieved with all nebuliser systems, and is not equivalent to continuously repeating conventional nebuliser doses.

Repeated doses of β_2 agonists should be given at 15-30 minute intervals or continuous nebulisation of salbutamol at 5-10mg/hour (requires appropriate nebulisers) used if there is an inadequate response initial treatment. Higher bolus doses, e.g. 10 mg of salbutamol, are unlikely to be more effective.

C) Steroid therapy

Steroid tablets reduce mortality, relapses, subsequent hospital admission and requirement for β_2 agonist therapy. The earlier they are given in the acute attack the better the outcome. (Rowe 2001)

Give steroid tablets in adequate doses in all cases of acute asthma.

Steroid tablets are as effective as injected steroids, provided tablets can be swallowed and retained. Doses of prednisolone of 40-50 mg daily or parenteral hydrocortisone 400mg daily (100mg six-hourly) are as effective as higher doses (Parameswaran 2001). Steroid tablets may be given as 8-12 x 5 mg tablets.

Continue prednisolone 40-50mg daily for at least five days or until recovery.

Following recovery from the acute exacerbation, steroid tablets can be stopped abruptly and doses do not need tapering provided the patient receives inhaled steroids (O'Dricoll 1993), (apart from patients on maintenance steroid treatment or rare instances where steroids are required for three or more weeks).

There is no evidence to suggest that inhaled steroids should be substituted for steroid tablets in treating patients with acute severe, or life threatening asthma. Further randomized controlled trials to determine the role of inhaled steroids in these patients are required.

Inhaled steroids do not provide benefit in addition to the initial treatment, but should be continued (or started as soon as possible) to form the start of the chronic asthma management plan.

D) Ipratropium bromide

Combining nebulised ipratropium bromide with a nebulised β_2 agonist has been shown to produce significantly greater bronchodilation that a β_2 agonist alone, leading to a faster recovery and shorter duration of admission. Anticholinergic treatment is not necessary and may not be beneficial in milder exacerbations of asthma or after stabilization (Stoodley, 1999).

> **Nebulised ipratropium bromide** (0.5mg 4-6 hourly) **should be added to β_2 agonist treatment for patients with acute severe or life threatening asthma or those with a poor initial response to β agonist therapy**.

E) Intravenous magnesium sulphate

A single dose of IV magnesium sulphate has been shown to be safe and effective in acute severe asthma who have **not** had a good initial response to treatment. (Rowe 2001). The safety and efficacy of repeated doses have not been assessed in patients with asthma. Repeated doses could give rise to hypermagnesaemia with muscle weakness and respiratory failure.

Consider giving a single dose of IV magnesium sulphate for patients with

- Acute severe asthma who have not had a good initial response to inhaled bronchodilator therapy
- Life threatening or near fatal asthma.

> *IV magnesium sulphate (1.2-2.0 g IV infusion over 20 minutes should only be used following consultation with senior medical staff.*

More studies are needed to determine the optimal frequency and dose of IV magnesium sulphate therapy.

F) Intravenous aminophylline

In acute asthma, the use of IV aminophylline is not likely to result in any additional bronchodilation compared to standard care with inhaled bronchodilators and steroid tablets. Side-effects such as palpitations, arrhythmias and vomiting are increased if IV aminophylline is used. (Parameswaran 2001)

Use of IV aminophylline only after consultation with senior medical staff.

Some individual patients with near fatal asthma or life threatening asthma with a poor response to initial therapy may gain additional benefit from IV aminophylline (5mg/kg loading dose over 20 minutes unless on maintenance oral therapy, then infusion of 0.5-0.7mg/kg/hr). Such patients are probably rare and could not be identified in a meta-analysis of trials involving 739 subjects. If IV aminophylline is given to patients on oral aminophylline or theophylline, blood levels should be checked on admission. Levels should be checked daily for all patients on aminophylline infusions. (Maintain between 10-20mg/L)

G) Antibiotics

When an infection precipitates an exacerbation of asthma it is likely to be viral in type. The role of bacterial infection has been overestimated.

Routine prescription of antibiotics is not indicated for acute asthma.

H) Intravenous fluids

There are no controlled trials or even observational or cohort studies of differing fluid regimes in acute asthma. Some patients with acute asthma require rehydration and correction of electrolyte imbalance. Hypokalaemia can be caused or exacerbated by β_2 agonist and/or steroid treatment and must be corrected.

I) Referral to intensive care

Indications for admission to intensive care facilities or a high dependency unit include patients requiring ventilatory support and those with severe acute or life threatening asthma who are failing to respond to therapy, as evidenced by:

- deteriorating PEF
- persisting or worsening hypoxia

- hypercapnoea
- arterial blood gas analysis showing fall in pH or rising H^+ concentration
- exhaustion, feeble respiration
- drowsiness, confusion
- coma or respiratory arrest.

Not all patients referred to the Intensive Care Unit (ICU) need ventilation, but those with worsening hypoxia or hypercapnea, drowsiness or unconsciousness and those who have had a respiratory arrest require intermittent positive pressure ventilation. Intubation in such patients referred may be very difficult. Intensive care management is not within the remit of these guidelines.

> ***All patients transferred to intensive care units should be accompanied by a doctor suitably equipped and skilled to intubate if necessary.***

J) Further investigation and monitoring

- Measure and record PEF 15-30 minutes after starting treatment, and thereafter according to the response. Measure and record PEF before and after nebulised or inhaled β agonist bronchodilator (at least four times daily) throughout the hospital stay and until controlled after discharge
- Record oxygen saturation by oximetry and maintain arterial SaO_2 > 92%
- Repeat measurements of blood gas tensions within two hours of starting treatment if:
  - the initial PaO_2 is <8kPa unless SaO_2 is >92%; or
  - the initial $PaCO_2$ is normal or raised; or
  - the patient's condition deteriorates
- Measure them again if the patient's condition has not improved by 4-6 hours
- Measure and record the heart rate.
- Measure serum potassium and blood glucose concentrations
- Measure the serum theophylline concentration if aminophylline is continued for more than 24 hours (aim at a concentration of 55-110µmol/L).

K) Asthma management protocols and proformas

The use of structured proformas has been shown to facilitate improvements in the process of care in A&E departments and hospital wards and to improve patient outcomes. The use of this type of documentation can assist data collection aimed at determining quality of care and outcomes.

L) HOSPITAL DISCHARGE AND FOLLOW UP (see Table 7)

Criteria for and timing of discharge from hospital and emergency departments have been studied. The key events in recovery appear to be improved symptoms and peak flow rather than a complete return to normality. Discharge when improvement is apparent may be as safe as discharge when full stability is achieved. Asthma specialist nurse education of adults and school-age (but not pre-school) children at or shortly after hospital attendance improves symptom control, self-management and re-attendance rates. (Wesseldine 1999, Smith 2000, Levy 2000, Greineder 1995).

4.3.3 Discharge Timing, Education and Follow-up

Timing of discharge

There is no single physiological parameter that defines absolutely the timing of discharge from an admission with acute asthma. Patients should have clinical signs compatible with home management, be on reducing amounts of β agonist (preferably no more than four hourly) and be on medical therapy they can continue safely at home.

Although diurnal variability of PEF is not always present during an exacerbation, evidence suggests that patients discharged with PEF <75% best or predicted and with diurnal variability >25% are at greater risk of early relapse and readmission. (Udwadia 1990).

Patient education

Following discharge from hospital or A&E departments, a proportion of patients re-attend A&E departments with more than 15% re-attending within two weeks. Some repeat attendees need emergency care, but many delay seeking help, and are under-treated and/or under-monitored. (Emerman 1999)

Prior to discharge, trained staff should give asthma education. This should include education on inhaler technique and PEF record keeping; with a written PEF and symptom-based action plan being provided allowing the patient to adjust their therapy within recommendations. These measures have been shown to reduce morbidity after the exacerbation and reduce relapse rates. (Cowie 1997).

There is some experience of a discrete population of patients who inappropriately use A&E departments rather than the primary care services for their asthma care (Nat. Asthma Task Force UK).

For the above groups there is a role for a trained asthma liaison nurse based in, or associated with the A&E department.

Follow-up

A careful history should elicit the reasons for the exacerbation and explore possible actions the patient should take to prevent future emergency room presentations.

Medication should be altered depending upon the assessment and the patient provided with an asthma action plan aimed at preventing relapse, optimizing treatment and preventing delay in seeking assistance in the future.

Table 6:

Features of Acute Asthma in Adults

Features of acute severe asthma:

- Peak expiratory flow (PEF) 33-50% of best (use % predicted if recent best unknown)
- Can't complete sentences in one breath
- Respirations ≥ 30 breaths/min
- Pulse ≥ 110 beats/min

Life threatening features - *ANY ONE OF*:

- PEF < 33% of best or predicted
- Silent chest, cyanosis, or feeble respiratory effort
- Bradycardia, dysrythmia, or hypotension
- Exhaustion, confusion, or coma
- SpO_2 < 92%
- Normal (4.6-6 kPa,, 35-45 mmHg) $PaCO_2$
- Severe hypoxia: PaO_2 < 8 kPa (60mmHg) irrespective of treatment with oxygen
- A low pH (or high H^+)

If a patient has any ONE life threatening feature, measure arterial blood gases, no other investigations are needed for immediate management.

Caution patients with severe or life threatening attacks may not be distressed and may not have all these abnormalities. The presence of any should alert the doctor.

Near fatal asthma:

- Raised $PaCO_2$
- Requiring IPPV with raised inflation pressures

Figure 7:

Management of Acute Severe Asthma in Adults - A&E and Ward

Features of acute severe asthma: • Peak expiratory flow (PEF) 33-50% of best *(use % predicted if recent best unknown)* • Can't complete sentences in one breath • Respirations ≥30 breaths/min • Pulse ≥ 110 beats/min	**IMMEDIATE TREATMENT:** • Oxygen 40-60% • (CO_2 retention is not usually aggravated by oxygen therapy in asthma) • Sabutamol 5mg via an oxygen-driven nebuliser • Ipratropium bromide 0.5 mg via an oxygen-driven nebuliser • Prednisolone tablets 40-50 mg or IV hydrocortisone 100mg or both if very ill • No sedatives of any kind • Chest radiograph only if pneumothorax or consolidation are suspected or patient requires IPPV or if another IF LIFE THREATENING FEATURES ARE PRESENT: • Discuss with senior clinician and ICU Team • Add IV magnesium sulphate 1.2-2.0g infusion over 20 minutes *(unless already given)* • Give nebulised β_2 agonist more frequently e.g. salbutamol 5 mg up to every 15-30 minutes or 10 mg continuously hourly.
If a patient has any ONE life threatening feature, measure arterial blood gases, no other investigations are needed for immediate management. **Caution** patients with severe or life threatening attacks may not be distressed and may not have all these abnormalities. The presence of any should alert the doctor. **Life threatening features - *ANY ONE OF*:** • PEF < 33% of best or predicted • Silent chest, cyanosis, or feeble respiratory effort • Bradycardia, dysrythmia, or hypotension • Exhaustion, confusion, or coma • SpO_2 < 92%	**SUBSEQUENT MANAGEMENT** IF PATIENT IS IMPROVING continue: • 40-60% oxygen • Prednisolone 40-50 mg daily or IV hydrocostisone 100 mg 6 hourly • Neubilised β_2 agonist and impratropium 4-6 hourly IF PATIENT NOT IMPROVING AFTER 15-30 MINUTES: • Continue oxygen and steroids • Give nebulised β_2 agonist more frequently e.g. salbutamol 5 mg up to every 15-30 minute or l0 mg continuously hourly • Continue Ipratropium 0.5 mg 4-6 hourly until patient is improving IF PATIENT IS STILL NOT IMPROVING: • Discuss patient with senior clinician and ICU team • IV magnesium sulphate 1.2-2.0 g over 20 minutes (unless already given) • Senior clinician may consider use of IV β_2 agonist or IV aminophylline or progression to IPPV.

Near fatal asthma: • Raised $PaCO_2$ • Requiring IPPV with raised inflation pressures	**MONITORING** • Repeat measurement of PEF 15-30 minutes after starting treatment • Oximetry: maintain $Sp0_2$ >92% • Repeat blood gas measurements within 2 hours of starting treatment if:-initial PaO_2 <8 kPa (60 mmHg) unless subsequent SpO_2 > 92% - PaO_2 normal or raised. - patient deteriorates • Chart PEF before and after giving β_2 agonists and at least 4 times daily throughout hospital stay **Transfer to ICU accompanied by a doctor prepared to intubate if:** • Deteriorating PEF, worsening or persisting hypoxia, or hypercapnea • Exhaustion, feeble respirations, confusion or drowsiness • Coma or respiratory arrest **DISCHARGE** When discharged from hospital, patients should have: • Been on discharge medication for 24 hours and *have had an inhaler technique checked and recorded* • PEF> 75% of best predicted and PEF diurnal variability <25% *unless discharge is agreed with respiratory physician* • Treatment with oral and inhaled steroids in addition to bronchodilators • Own PEF meter and written asthma action plan • GP follow up arranged *within 2 working days* • Follow up appointment in respiratory clinic *within 4 weeks* Patients with severe asthma (indicated by need for admission) and adverse behavioral or psychosocial features are at risk of further severe or fatal attacks • Determine reason(s) for exacerbation and admission • Send details of admission, discharge and potential best PEF to GP

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