MedicineToday 2014; 15(9): 14-28

PEER REVIEWED FEATURE
2 CPD POINTS

Age-specific management of asthma in children

PETER VAN ASPEREN MB BS, MD, FRACP, F Thor Soc
PAUL ROBINSON MB ChB, MRCPCH, FRACP, PhD

Changes to the National Asthma Council Australia asthma guidelines in the recently released *Australian Asthma Handbook* include age-specific recommendations on diagnosis, assessment and management of asthma in children.

Key points

- **Diagnosis of asthma in children is based primarily on the presence of variable respiratory symptoms supported by spirometric evidence of reversible airflow limitation where feasible and/or response to asthma treatment.**
- **The use and choice of preventer treatment should be guided by the pattern of asthma symptoms whereas ongoing management should be guided by asthma control.**
- **Management recommendations differ between children aged 0 to 5 years and older children, with a lower threshold for specialist referral in younger children.**
- **Most children who require an asthma preventer will achieve good control with montelukast or low-dose inhaled corticosteroids.**
- **Education about asthma and inhaler use and provision of a written asthma action plan are as important as medications in ensuring good asthma control.**

The launch of the revised National Asthma Council Australia (NAC) asthma guidelines as an online resource in March 2014 – renamed as the *Australian Asthma Handbook* (AAH) – provides an opportunity to review current issues in paediatric asthma management.[1] Although the principles of management have not changed significantly, it has been recognised that age-specific recommendations are needed to reflect both diagnostic issues and the paucity of clinical trials in preschool-aged children (defined as age 0 to 5 years), which makes evidence-based recommendations more difficult in this age group.

The AAH guidelines have also shifted to using asthma control as the principal basis for ongoing asthma assessment, while retaining assessment of asthma pattern as the basis for the decision to initiate asthma preventer treatment. Finally, the AAH has increased the focus on recognition and response to severe and life-threatening asthma, although the principles of acute asthma management remain the same.

This review discusses the AAH age-specific recommendations for the diagnosis, assessment and management of children with asthma and the available evidence on which these recommendations were based. Relevant tables and figures from the AAH are reproduced to highlight these recommendations. Important recent

Professor van Asperen is Senior Staff Respiratory Physician in the Department of Respiratory Medicine, The Children's Hospital at Westmead, Sydney Children's Hospital Network; and Macintosh Professor of Paediatric Respiratory Medicine and Acting Associate Dean at The Children's Hospital at Westmead Clinical School, Discipline of Paediatrics and Child Health, Sydney Medical School, University of Sydney, Sydney. Dr Robinson is a Staff Respiratory Physician in the Department of Respiratory Medicine, The Children's Hospital at Westmead, Sydney Children's Hospital Network; and Clinical Senior Lecturer at The Children's Hospital at Westmead Clinical School, Discipline of Paediatrics and Child Health, Sydney Medical School, University of Sydney, Sydney, NSW.

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

1. FINDINGS THAT INCREASE OR DECREASE THE PROBABILITY OF ASTHMA*

Asthma more likely

- More than one of:
  - wheeze
  - difficulty breathing
  - feeling of tightness in the chest
  - cough
- AND any of:
  - symptoms recur frequently
  - symptoms worse at night and in the early morning
  - symptoms triggered by exercise, exposure to pets, cold air, damp air, emotions, laughing
  - symptoms occur when child does not have a cold
  - history of allergies (e.g. allergic rhinitis, atopic dermatitis)
  - family history of allergies
  - family history of asthma
  - widespread wheeze heard on auscultation
  - symptoms respond to treatment trial of reliever, with or without a preventer
  - lung function measured by spirometry increases in response to rapid-acting bronchodilator
  - lung function measured by spirometry increases in response to a treatment trial with inhaled corticosteroid (where indicated)

Asthma less likely

Any of:

- symptoms only occur when child has a cold, but not between colds
- isolated cough in the absence of wheeze or difficulty breathing
- history of moist cough
- dizziness, light-headedness or peripheral tingling
- repeatedly normal physical examination of chest when symptomatic
- normal spirometry when symptomatic (children old enough to perform spirometry)
- no response to a trial of asthma treatment
- clinical features that suggest an alternative diagnosis

* Sources: British Thoracic Society, Scottish Intercollegiate Guidelines Network (2012);[4] Respiratory Expert Group (2009).[5] Reproduced with permission from *Australian Asthma Handbook* (2014).[1]

literature on asthma classification and treatment that may lead us to modify our approach to paediatric asthma management in the future is also discussed. A detailed discussion of the assessment and management of acute asthma in children is beyond the scope of this review, but can be found in the AAH.[1] Further more detailed information on current and potential future treatment options is contained in our two recent reviews.[2,3]

DIAGNOSIS OF ASTHMA IN CHILDREN

Definition of asthma

The AAH clinical definition of asthma in children is 'the combination of variable respiratory symptoms (e.g. wheeze, shortness of breath, cough and chest tightness) and excessive variation in lung function, i.e. variation in expiratory airflow that is greater than that seen in healthy children ("variable airflow limitation")'.[1] However, the AAH also recognises that 'in young children in whom lung function testing is not feasible, including most preschool children, asthma is defined by the presence of variable respiratory symptoms'.

The findings that increase or decrease

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

2. CONDITIONS THAT CAN BE CONFUSED WITH ASTHMA IN CHILDREN*

Conditions characterised by cough
- Pertussis (whooping cough)
- Cystic fibrosis
- Airway abnormalities (e.g. tracheomalacia, bronchomalacia)
- Protracted bacterial bronchitis in young children
- Habit cough syndrome

Conditions characterised by wheezing
- Upper airway dysfunction
- Inhaled foreign body causing partial airway obstruction
- Tracheomalacia

Conditions characterised by difficulty breathing
- Hyperventilation
- Anxiety
- Breathlessness on exertion due to poor cardiopulmonary fitness

* Source: Weinberger M, Abu-Hasan M. Pediatrics 2007; 120: 855-864.[6]

asthma probability in children are summarised in Box 1.[4,5] Emphasis is placed on the fact that isolated cough in the absence of wheeze or difficulty breathing make asthma less likely. The importance of considering alternative diagnoses, particularly when cough or exercise-induced shortness of breath is the major presenting symptom, is also highlighted.

Although the 'asthma less likely' criteria include 'symptoms only occur when child has a cold, but not between colds', it is important to note that many children have predominantly viral-induced wheezing, particularly in the preschool years. There is currently debate whether this should be labelled as asthma, as discussed below.

Differential diagnosis

Examples of conditions that can be confused with asthma in children are listed in Box 2 and are further explored in a 2007 review.[6] These include conditions that cause cough, wheezing or difficulty breathing. Further information on the approach to assessment and management of children with persistent cough can be found in the *Cough in Children and Adults: Diagnosis and Assessment* (CICADA) guidelines.[7]

Although upper airway dysfunction and tracheomalacia can present with wheezing, the predominant sound in upper airway dysfunction is inspiratory stridor (often confused with wheeze) whereas in tracheomalacia a barking cough may be the main clinical manifestation.

Asthma versus wheeze in children

Diagnosing asthma in children aged 0 to 5 years can be difficult because:
- episodic respiratory symptoms such as cough and wheeze are common in early childhood,
- in a significant proportion of children, bronchodilator-reversible wheezing improves with age
- spirometry has limited feasibility in this age group.

There has been a push to use the recent European Respiratory Society (ERS) classification of 'episodic (viral) wheeze' and 'multiple trigger wheeze' and to avoid the term 'asthma' in the preschool-aged group.[8] However, recent literature suggests that the distinction of these wheezing phenotypes from 'asthma' may not be necessary, and that asthma should be viewed not as a single disease entity but as a condition with different causes, each having a different natural history and requiring a different treatment approach. For example, in a recent study of virus-induced wheezing episodes in children aged between 4 and 6 years, the authors concluded that mild episodes of wheeze in preschool-aged children were characterised by asthma-related symptoms, reversible airflow limitation and enhanced airway inflammation, suggesting they are indeed part of the clinical 'asthma' spectrum.[9]

In fact, wheeze patterns in young children vary over time and with treatment, a fact highlighted in a prospective follow-up study of preschool-aged children with wheeze.[10] This was acknowledged in the recent update of the ERS classification of preschool wheezing, rendering the distinction between episodic viral wheeze and multiple trigger wheeze unclear in some patients, consistent with them being part of the clinical 'asthma' spectrum.[11] This overlap is also reflected in the AAH, where the treatment approach recommended for patients with episodic viral wheeze equates to that for patients with intermittent asthma, and multiple trigger wheeze to that of persistent asthma (see later discussion).

Summary

Although a clinical diagnosis of asthma in younger children may be more difficult than in older children and adults, the AAH outlines a useful, sound approach (see the flowchart). This approach is based around the following potential diagnostic features:
- history of recurrent or persistent wheeze
- presence of allergies or family history of asthma and allergies
- absence of physical findings that suggest an alternative diagnosis
- test results that support the diagnosis (e.g. spirometry in children able to perform it)
- a consistent clinical response to an inhaled bronchodilator or preventer.

ASSESSMENT OF ASTHMA IN CHILDREN

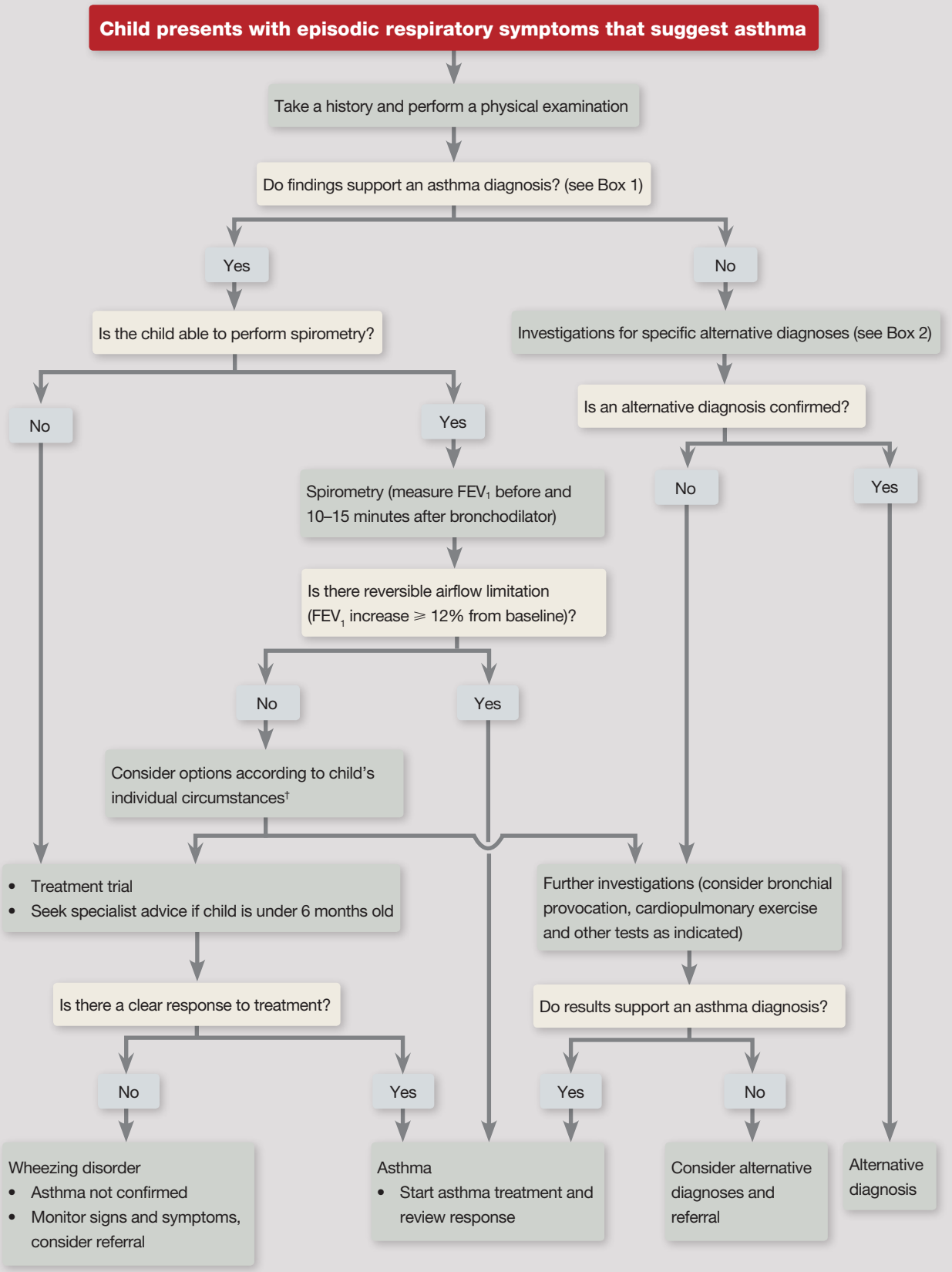
Pattern of asthma

Once asthma has been diagnosed, the pattern of asthma should be determined to direct the need for, and type of, preventer medication required. Categorisation is determined by both:
- episode frequency
- presence and severity of symptoms between episodes.

AAH definitions of asthma patterns are shown in Table 1 for children of different

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

SUGGESTED STEPS IN THE DIAGNOSIS OF ASTHMA IN CHILDREN*



ABBREVIATION: FEV_1 = forced expiratory volume in one second.
* Modified from *Australian Asthma Handbook* (2014).[1]
† Including the child's ability to do a bronchial provocation or cardiopulmonary exercise test.

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

TABLE 1. DEFINITIONS OF ASTHMA PATTERNS IN CHILDREN OF DIFFERENT AGES NOT TAKING ASTHMA PREVENTER*

Category	Pattern and intensity of symptoms (when not taking regular treatment)	
	Children aged 0 to 5 years	**Children aged 6 years and over**
Infrequent intermittent asthma†	Symptom-free for at least 6 weeks at a time (symptoms up to once every 6 weeks on average but no symptoms between flare-ups)	Symptom-free for at least 6 weeks at a time (symptoms up to once every 6 weeks on average but no symptoms between flare-ups)
Frequent intermittent asthma	Symptoms more than once every 6 weeks on average but no symptoms between flare-ups	Symptoms more than once every 6 weeks on average but no symptoms between flare-ups
Persistent asthma		
• Mild	At least one of: • daytime symptoms more than once per week but not every day‡ • night-time symptoms more than twice per month but not every week‡	FEV_1 ≥80% predicted and at least one of: • daytime symptoms more than once per week but not every day‡ • night-time symptoms more than twice per month but not every week‡
• Moderate	Any of: • daytime symptoms daily‡ • night-time symptoms more than once per week‡ • symptoms sometimes restrict activity or sleep	Any of: • FEV_1 <80% predicted‡ • daytime symptoms daily‡ • night-time symptoms more than once per week‡ • symptoms sometimes restrict activity or sleep
• Severe	Any of: • daytime symptoms continual‡ • night-time symptoms frequent‡ • flare-ups frequent • symptoms frequently restrict activity or sleep	Any of: • FEV_1 ⩽60% predicted‡ • daytime symptoms continual‡ • night-time symptoms frequent‡ • flare-ups frequent • symptoms frequently restrict activity or sleep

ABBREVIATION: FEV_1 = forced expiratory volume in one second.

* Reproduced with permission from *Australian Asthma Handbook* (2014).[1] Note: In children aged 5 years or younger, use this table when the diagnosis of asthma can be made with reasonable confidence (e.g. a child with wheezing accompanied by persistent cough or breathing difficulty, no signs or symptoms that suggest a potentially serious alternative diagnosis, and the presence of other factors that increase the probability of asthma such as family history of allergies or asthma).

† It may not be appropriate to make the diagnosis of asthma in children aged 6 years or older who wheeze only during upper respiratory tract infections. These children can be considered to have episodic (viral) wheeze.

‡ Symptoms between flare-ups. A flare-up is defined as a period of worsening asthma symptoms, from mild (e.g. symptoms that are just outside the normal range of variation for the child, documented when well) to severe (e.g. events that require urgent action by parents and health professionals to prevent a serious outcome such as hospitalisation or death from asthma).

ages. The only difference in definitions used between children aged 0 to 5 years and those aged 6 years and over is the inclusion of spirometry criteria for the older children. It is well recognised that most children with asthma have an intermittent pattern of symptoms: 70% have infrequent intermittent asthma, 20 to 25% have frequent intermittent asthma; and thus only 5 to 10% of children have persistent asthma. These are important figures to remember when we discuss the recommended approach to management of asthma in children.

Asthma control

Once a child is on regular preventer medication, categorisation of the asthma pattern is no longer valid or meaningful, and assessment of recent asthma control is required, based on symptoms over the previous four weeks (Table 2).[1,12] Formal questionnaire-based instruments, validated for assessing asthma control in children, include:

- the Asthma Control Questionnaire (ACQ; for children aged 6 years and over)
- Test for Respiratory and Asthma Control in Kids (TRACK; for children aged under 5 years)
- Childhood Asthma Control Test (C-ACT; for children aged 4 to 11 years).

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

TABLE 2. DEFINITION OF LEVELS OF RECENT ASTHMA SYMPTOM CONTROL IN CHILDREN (REGARDLESS OF CURRENT TREATMENT REGIMEN)*

Good control	Partial control	Poor control
All of: • daytime symptoms ⩽2 days per week† (lasting only a few minutes and rapidly relieved by rapid-acting bronchodilator) • no limitation of activities‡ • no symptoms during night or when wakes up¶ • need for reliever†† ⩽2 days per week	Any of: • daytime symptoms >2 days per week† (lasting only a few minutes and rapidly relieved by rapid-acting bronchodilator) • any limitation of activities§ • any symptoms during night or when wakes up** • need for reliever†† >2 days per week	Either of: • daytime symptoms >2 days per week† (lasting from minutes to hours or recurring, and partially or fully relieved by rapid-acting bronchodilator) • three or more features of partial control within the same week

* Adapted from: Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention, 2014.[12] Reproduced with permission from *Australian Asthma Handbook* (2014).[1] Note: Recent asthma control is based on symptoms over the previous four weeks. Each child's risk factors for future asthma outcomes should also be assessed and taken into account in management.
† For example, wheezing or breathing problems.
‡ Child is fully active; runs and plays without symptoms.
§ For example, wheeze or breathlessness during exercise, vigorous play or laughing.
¶ Including no coughing during sleep.
** For example, waking with symptoms of wheezing or breathing problems.
†† Not including short-acting beta$_2$-agonist taken prophylactically before exercise. (Record this separately and take into account when assessing management.)

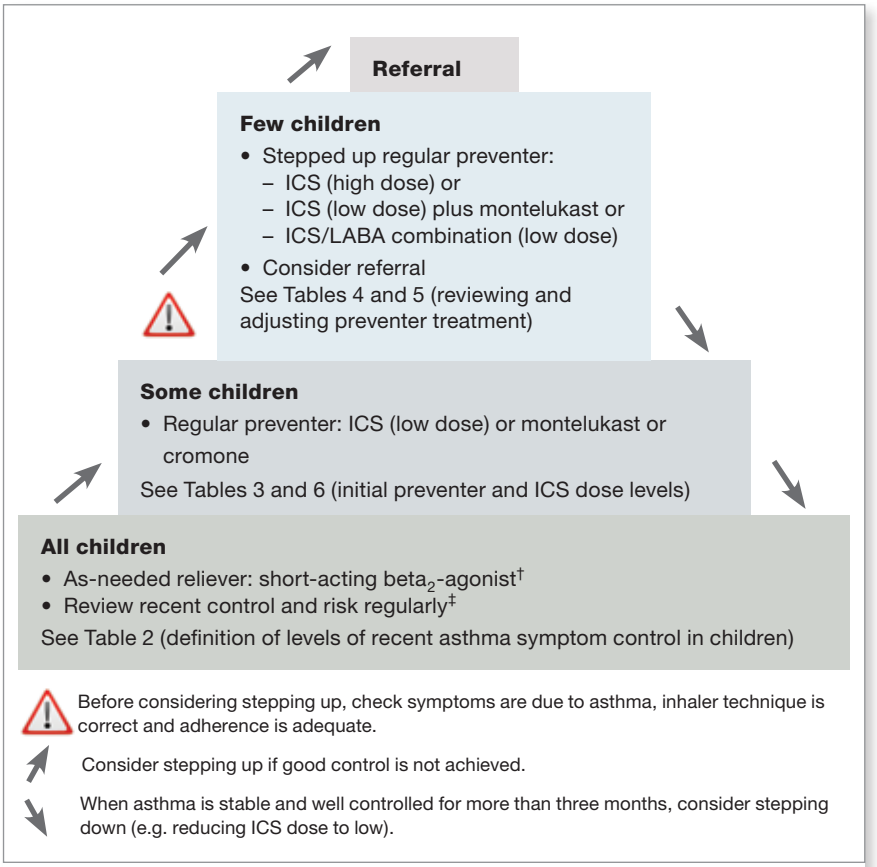


Figure 1. Stepped approach to adjusting asthma medication in children*

ABBREVIATIONS: ICS = inhaled corticosteroid; LABA = long-acting beta$_2$ agonist.

* Reproduced with permission from *Australian Asthma Handbook* (2014).[1]
† Or low-dose budesonide/eformoterol combination, only for children aged 12 years or over who are using this combination as both maintenance and reliever.
‡ In addition, manage flare-ups with extra treatment when they occur, and manage exercise-related asthma symptoms as indicated.

Ongoing assessment of recent asthma control determines the need to alter current asthma management. Recommendations include:

- escalation of treatment in children with partial or poor control (provided that incorrect diagnosis, poor adherence or poor inhaler technique have been excluded)
- reduction of treatment in those who have been well controlled for three to six months (see below).

MANAGEMENT OF ASTHMA IN CHILDREN

As highlighted in the AAH, the aims of asthma management are 'to ensure that the child's asthma has been correctly diagnosed, and to enable the child to maintain a normal quality of life without interference from asthma or the side effects of asthma treatment'.[1]

Stepwise approach

The AAH continues to advocate a stepwise approach to asthma management, as recommended by other international asthma guidelines (Figure 1).[4,12] Although the overall approach is valid for children of all ages, there are important differences for those aged 0 to 5 years compared with older age groups, both in the choice of preventer and add-on treatments and the threshold for referral for specialist review

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

(Tables 3 to 5; discussed below). The AAH treatment recommendations are also consistent with the Thoracic Society of Australia and New Zealand (TSANZ) 2010 position paper on the role of corticosteroids in the management of childhood asthma.[13]

The following recommendations apply to children of all ages.

Who requires preventer treatment?

- For infrequent intermittent asthma (70% of children with asthma),

TABLE 3. INITIAL PREVENTER TREATMENT FOR CHILDREN OF DIFFERENT AGES*

Age	Pattern of symptoms†	Management options and notes‡
0–12 months	• Intermittent asthma or • Viral-induced wheeze	• Regular preventer treatment is not recommended
	• Persistent asthma or • Multiple-trigger wheeze	• Refer for specialist assessment or obtain specialist advice before prescribing
1–2 years	• Intermittent asthma or • Viral-induced wheeze	• Regular preventer treatment is not recommended
	• Persistent asthma or • Multiple-trigger wheeze	• Consider a treatment trial with a cromone (sodium cromoglycate or nedocromil) and review response in 2–4 weeks§ • Consider a treatment trial of low-dose inhaled corticosteroids only if wheezing symptoms are disrupting child's sleeping or play; review response in 4 weeks
2–5 years	• Infrequent intermittent asthma or • Viral-induced wheeze	• Regular preventer treatment is not recommended
	• Frequent intermittent asthma or • Mild persistent asthma or • Episodic (viral) wheeze with frequent symptoms or • Mild multiple-trigger wheeze	• Consider regular treatment with montelukast 4 mg once daily and review response in 2–4 weeks • If symptoms do not respond, consider regular treatment with a low dose of an inhaled corticosteroid and review response in 4 weeks
	• Moderate–severe persistent asthma or • Moderate–severe multiple-trigger wheeze	• Consider regular treatment with a low-dose inhaled corticosteroid and review response in 4 weeks
6 years and over	• Infrequent intermittent asthma¶	• Regular preventer treatment is not recommended
	• Frequent intermittent asthma	• Consider a treatment trial with montelukast 5 mg once daily; assess response after 2–4 weeks • Note: a cromone (sodium cromoglycate or nedocromil) can be trialled as an alternative§
	• Mild persistent asthma	• Consider a treatment trial with montelukast 5 mg once daily; assess response after 2–4 weeks • If inadequate response after checking adherence, consider treatment trial with inhaled corticosteroid (low dose) • Note: a cromone (sodium cromoglycate or nedocromil) can be trialled as an alternative§
	• Moderate-to-severe persistent asthma	• Consider a treatment trial with regular inhaled corticosteroid (low dose); assess response after 4 weeks

* Reproduced with permission from *Australian Asthma Handbook* (2014).[1]
† Pattern of symptoms when not taking regular preventer treatment.
‡ In addition to use of rapid-onset inhaled beta$_2$-agonist when child experiences difficulty breathing.
§ Cromone inhaler device mouthpieces require daily washing to avoid blocking.
¶ Also applies to children who wheeze only during upper respiratory tract infections and do not have a diagnosis of asthma.

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

relievers (short-acting beta$_2$-agonists with or without oral corticosteroids) as needed for asthma flare-ups remain the recommended treatment. No preventer is required.

- For frequent intermittent asthma (20 to 25% of children with asthma) or persistent asthma (5 to 10%), preventer therapy is recommended, as highlighted in Figure 1 ('Some children' box).

TABLE 4. REVIEWING AND ADJUSTING PREVENTER TREATMENT FOR CHILDREN AGED 0 TO 5 YEARS*

Initial treatment	When to schedule review	Management options and notes	
		Treatment response	**No treatment response†**
Montelukast (children 2 years and over)‡	2–4 weeks	• Continue montelukast treatment	• Stop montelukast and start treatment with an inhaled corticosteroid, starting with a low dose
Inhaled corticosteroid (low dose)	4 weeks	• Continue regular treatment at low dose • After ⩾3 months, consider stopping treatment and reviewing in 4 weeks	• Review the diagnosis, adherence and inhaler technique • Consider referral to a specialist (e.g. paediatric respiratory physician or paediatrician, if available) for assessment • Consider adding montelukast (in combination with inhaled corticosteroid)‡

* Reproduced with permission from *Australian Asthma Handbook* (2014).[1]

† Symptom control not achieved with initial treatment after verifying treatment was taken as intended.

‡ PBS status as at August 2014: montelukast is not currently subsidised by the PBS for children aged 2 to 5 years with moderate-to-severe persistent asthma, or when used in combination with another preventer.

TABLE 5. REVIEWING AND ADJUSTING PREVENTER TREATMENT FOR CHILDREN AGED 6 YEARS AND OVER*

Initial treatment	When to schedule review	Management options and notes	
		Treatment response (symptoms well controlled)	**No or partial response†**
Montelukast or cromones	2–4 weeks	• Continue treatment • Set review date (e.g. 3 months)	• Stop treatment and start treatment with an inhaled corticosteroid, starting with a low dose
Inhaled corticosteroid (low dose)	4 weeks	• Continue regular treatment at low dose • Set review date (e.g. 3 months)	• Consider one of the following options:‡ – add montelukast in addition to inhaled corticosteroid (children 6–14 years)§ – increase the dose of inhaled corticosteroid; reassess in 2–4 weeks – switch to combination long-acting beta$_2$-agonist/inhaled corticosteroid

* Reproduced with permission from *Australian Asthma Handbook* (2014).[1]

† Symptom control not achieved with initial treatment after verifying treatment was taken as intended.

‡ Before considering a change in the treatment regimen: review the diagnosis, adherence and inhaler technique; and consider referral to a specialist (e.g. paediatric respiratory physician or paediatrician, if available) for assessment.

§ PBS status as at August 2014: montelukast is not subsidised by the PBS for people aged 15 years or over.

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

Stepping up treatment

In children whose asthma remains partially or poorly controlled despite regular preventer treatment, it is essential to ensure that the diagnosis of asthma is correct and that adherence and inhaler technique are appropriate before stepping up treatment. It is important to remember that most children with asthma who require preventer treatment will achieve adequate control with montelukast or low-dose inhaled corticosteroids (ICS). The AAH troubleshooting checklist is a useful reminder of what to consider if a child is not responding well to treatment (Box 3).[1]

Stepping down treatment

Of equal importance is to consider stepping down the level of preventer treatment or even ceasing it in children whose asthma has been well controlled for at least three months.

A poor response to treatment may also suggest that asthma is not the cause of the symptoms and is another scenario where ceasing regular preventer treatment should be considered (e.g. the child with persistent cough). Ceasing treatment to assess whether the child's condition worsens is more appropriate than escalating treatment and potentially exposing the child to an unnecessary risk of treatment side effects.

This stepwise approach to ongoing asthma management, including regular review, helps to ensure that children diagnosed with asthma are neither undertreated nor overtreated.

3. TROUBLESHOOTING CHECKLIST*

Is the patient taking the medicine correctly?

- Is the person taking the medicine/s?
- Are there any reasons the person may be missing some or all doses? (e.g. cost, psychosocial reasons)
- Is the person's inhaler technique correct?
- Is the type of inhaler device right for the person?

Is the current treatment appropriate?

- Is the type of preventer right for the individual?
- Is the prescribed dose of preventer likely to be effective?

Is the person able to self-manage effectively?

- Is the written asthma action plan up to date and does the person know how to follow it?
- Is the person receiving conflicting advice from other health professionals?
- Is the person unable to manage their asthma due to life events, low health literacy, personal circumstances or other psychosocial factors?

Are the symptoms due to asthma?

- Is the diagnosis correct?
- Are other conditions present?

Is the person exposed to unidentified triggers?

- Does the person smoke?
- Is the person exposed to other people's tobacco smoke or other smoke?
- Does the person know what triggers their asthma symptoms?
- Consider:
  - cigarette smoke
  - allergens (e.g. animals, pollens, workplace materials)
  - cold/dry air
  - indoor and outdoor pollution
  - medicines (including complementary medicines)
  - food chemicals/additives (if person is intolerant)
  - viral respiratory tract infections
  - comorbid medical conditions
  - extreme emotions
  - hormonal changes
  - exercise

* Reproduced with permission from *Australian Asthma Handbook* (2014).[1]

Preventer treatment in children aged 0 to 5 years

Initial preventer treatment

The AAH recommendations for initial preventer treatment in the first five years of life are summarised in Table 3.[1] As mentioned previously, intermittent asthma and episodic viral wheeze are considered as one entity for the purpose of management recommendations, as are persistent asthma and multiple trigger wheeze.

For children aged 0 to 12 months, the list of differential diagnoses for wheeze is lengthy and specialist referral should be considered for those with troublesome wheezing before commencing preventer therapy.

For children aged between 1 and 2 years with persistent wheeze, an initial trial of a cromone is suggested as montelukast is currently not approved for children under 2 years of age. However, the difficulties of cromone administration, related to clogging of the actuator requiring regular washing, are acknowledged. In this age group, ICS are recommended only if wheezing symptoms are disrupting the child's sleep or play.

For children aged 2 to 5 years, an initial trial of montelukast is recommended for frequent intermittent asthma or mild persistent asthma, whereas ICS are the initial preventer treatment of choice for moderate or severe persistent asthma.

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

TABLE 6. DEFINITIONS OF INHALED CORTICOSTEROID DOSE LEVELS IN CHILDREN*

Inhaled corticosteroid	Daily dose (µg)	
	Low	High
Beclomethasone dipropionate†	100–200	>200 (up to 400)
Budesonide	200–400	>400 (up to 800)
Ciclesonide‡	80–160	>160 (up to 320)
Fluticasone propionate	100–200	>200 (up to 500)

* Source: van Asperen PP, et al (2010).[13] Reproduced with permission from *Australian Asthma Handbook* (2014).[1]
† Dose equivalents for a chlorofluorocarbon-free formulation of beclomethasone dipropionate currently available in Australia.
‡ Ciclesonide is registered for use in children aged 6 and over.

Although some evidence supports the use of intermittent ICS and montelukast for children with intermittent viral-induced wheezing/asthma, (e.g. the TSANZ position paper[13]), these are currently not approved PBS indications for either of these medications.

Reviewing and adjusting preventer treatment

Table 4 provides details for reviewing and adjusting preventer treatment in children aged 0 to 5 years and again highlights the need to ensure correct diagnosis, good adherence and appropriate inhaler technique before treatment escalation.[1] After a failed four-week trial of montelukast, changing to low-dose ICS is recommended. However, in children in whom low-dose ICS is the initial treatment trialled (see Table 6 for definition of low and high doses of ICS in children), referral for specialist review is suggested if symptoms remain inadequately controlled.

Importantly, the potential add-on options do not include long-acting beta-agonists (LABAs), which are not recommended for children aged 0 to 5 years. This caution about use of LABAs in this age group is also found in the recent TSANZ position paper and the GINA guidelines for management of asthma in children 5 years and younger.[12,13] This reflects the paucity of studies in this age group, as highlighted in recent publications.[14,15] Add-on montelukast is an option for this age group

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

but is currently not PBS subsidised for this indication in children aged 0 to 5 years.

Preventer treatment in children aged 6 years and over

Initial preventer treatment

AAH recommendations for initial preventer treatment for children aged 6 years and over are summarised in Table 3. Montelukast is the recommended initial treatment for children with frequent intermittent or mild persistent asthma (with cromones as an alternative), whereas low-dose ICS are recommended for children with moderate or severe persistent asthma.

Reviewing and adjusting preventer treatment

Details for reviewing and adjusting preventer treatment in children aged 6 years and over are provided in Table 5. For children who do not achieve adequate control on low-dose ICS, three options exist:

- adding montelukast to the current dose of ICS
- increasing the current dose of ICS
- adding LABA to the current dose of ICS (i.e. using a combination ICS/LABA inhaler).

The evidence for the efficacy and safety of these three options is provided in more detail in the AAH, the TSANZ position paper and other recent reviews.[1,13-15]

It is clear that different options may provide the best outcomes in different individual patients.[16] Montelukast provides better long-term protection against exercise-induced bronchoconstriction with less likelihood of down regulation of the beta-receptors and loss of efficacy of short-acting $beta_2$-agonists, a recognised concern with regular LABA use.[17] It also appears that young children may be at increased risk of these adverse LABA effects.[18] A recent study targeted children carrying two copies of a particular polymorphism in the beta-receptor gene (Arg16) that is associated with greater likelihood of down regulation of this receptor. In these children, who were also not adequately controlled on ICS alone, addition of montelukast provided better outcomes than the addition of LABA.[19] Clearly this study needs replication, but it suggests the future possibility of employing a pharmacogenetic approach to adjusting treatment in children with asthma.

4. CHILDHOOD ASTHMA EDUCATION CHECKLIST*

Asthma symptoms and signs

- Explain that asthma is a long-term condition that is still there even when the child does not have current symptoms, and which involves abnormally sensitive or inflamed breathing tubes (airways) in the lungs
- Explain the causes of wheezing and breathlessness (narrowing of airways due to contraction of smooth muscle in airway wall, swelling of lining of airways, increased mucus secretion into airway)
- Explain that the severity of a particular asthma flare-up (e.g. acute asthma causing a trip to the emergency department) is not the same as the severity of the child's asthma overall
- Describe the warning signs that mean the child needs to take reliever, needs a doctor or needs emergency care
- Mention some common factors that can trigger children's asthma (e.g. colds, exercise, allergens, tobacco smoke). Provide advice on triggers that can be avoided

Asthma medicines

- Explain that relievers make the abnormally narrowed breathing tubes (airways) wider so it is easier to breathe
- Explain that relievers should only be used when the child has symptoms, or before exercise if prescribed for exercise-induced bronchoconstriction
- Explain that relievers should not be used at other times 'just in case', and that using reliever too often is a sign that the child's asthma is poorly controlled – the child may need regular medicine
- Explain that preventers (inhaled corticosteroids, montelukast, and combinations of inhaled corticosteroid and long-acting $beta_2$-agonist) work mainly by settling down the inflammation in the airways. Combination preventers (inhaled corticosteroid plus long-acting $beta_2$-agonist) also contain a second medicine that helps keep narrow airways open
- Emphasise that preventers must be taken regularly to work properly
- Explain the possible side effects of inhaled corticosteroids and how to minimise them (following directions closely, using a spacer, rinsing and spitting after use)
- Explain that other medicines are used during acute asthma ('attacks')

Inhaler devices

- Explain how to use a puffer and spacer or other inhaler device properly
- Physically demonstrate how to use the device, provide training, then watch the child or parents perform each step
- Explain how to clean and care for inhalers and spacers

Written asthma action plan

- Provide a written asthma action plan and explain how to use it
- Provide a plan for the child's school or childcare centre

* Reproduced with permission from *Australian Asthma Handbook* (2014).[1]
Note: For children with difficult-to-treat asthma or comorbid conditions, provide more detailed information.

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

5. RESOURCES ON CHILDHOOD ASTHMA

- *Australian Asthma Handbook*. Version 1.0. National Asthma Council Australia (NAC). Melbourne: NAC; 2014 (http://www.asthmahandbook.org.au)
- *CICADA: Cough in Children and Adults: Diagnosis and Assessment. Australian Cough Guidelines Summary Sstatement*. Gibson PG, Chang AB, Glasgow NJ, et al. Med J Aust 2010; 192: 265-271.
- *The Role of Corticosteroids in the Management of Childhood Asthma.* Thoracic Society of Australia and New Zealand (TSANZ) position paper. van Asperen PP, Mellis CM, Sly PD, Robertson CF. Sydney: TSANZ; 2010 (http://www.thoracic.org.au/imagesDB/wysiwyg/Steroidsinasthma_2010.pdf)
- *Global Strategy for Asthma Management and Prevention*. Global Initiative for Asthma (GINA). GINA; 2014 (http://www.ginasthma.org)

Although the recommended threshold for specialist referral is higher for children aged 6 years and over, specialist review should still be considered for these children, particularly if there is anything unusual in the history or treatment response and also if asthma control is difficult to achieve.

Finally it is important to again highlight that most children with asthma who require preventer treatment will achieve adequate control with montelukast or low-dose ICS and that there is no current evidence to support the use of combination ICS/LABA as first-line preventer treatment in children.[15]

OTHER MANAGEMENT ISSUES

A detailed discussion of other management issues is beyond the scope of this review. However, the troubleshooting checklist in Box 3 highlights some of the important management issues that need to be considered when children are not responding to treatment. The AAH provides more detailed information about these aspects of management, including nonpharmacological approaches (see the clinical issues and prevention sections). A suggested management approach in adolescents and young adults that highlights the important considerations in this age group is also included in the population section of the AAH and was summarised in the July 2014 issue of *Medicine Today*.[1,20]

Of equal importance to pharmacological and nonpharmacological approaches in overall management is provision of education and a written asthma action plan. Box 4 provides a detailed checklist of AAH recommended educational information. This covers discussion about symptoms and signs of asthma, including signs of flare-ups and triggers, medications and the rationale for their use, inhaler use and care, and provision of an asthma action plan with explanation of how it should be used.

CONCLUSION

The recently released AAH provides up to date evidence-based recommendations for the diagnosis, assessment and management of asthma in children. It aims to ensure that the child's asthma has been correctly diagnosed and to enable the child to maintain a normal quality of life without interference from asthma or the side effects of asthma treatment. Relevant resources on childhood asthma are listed in Box 5.

The AAH continues to promote a stepwise approach to asthma management based on an initial assessment of the pattern of asthma and ongoing review of asthma control. However, the AAH highlights important differences in the approach to diagnosis and management of asthma in children aged 0 to 5 years and older children, reflecting the greater difficulty of diagnosing asthma and the paucity of clinical trial data in the younger age group. The AAH also advocates a lower threshold for specialist referral in children aged 0 to 5 years and recommends that LABA add-on not be used in this age group. It emphasises the importance of excluding incorrect diagnosis, poor adherence or poor inhaler technique in children whose asthma remains poorly controlled by first-line preventer treatment. It also highlights the importance of nonpharmacological approaches and education in the management of paediatric asthma. MT

REFERENCES

A list of references is included in the website version (www.medicinetoday.com.au) and the iPad app version of this article.

COMPETING INTERESTS: The Department of Respiratory Medicine at The Children's Hospital at Westmead has received funding in the past from GlaxoSmithKline, Astra Zeneca, Merck Sharp and Dohme, Boehringer Ingelheim and Altana for involvement in clinical trials on asthma medications. The Department is currently receiving funding from GSK for a safety study on Seretide in children with asthma in which both Professor van Asperen and Dr Robinson are investigators. Professor van Asperen and Dr Robinson have no significant financial interest in any pharmaceutical company.

Online CPD Journal Program

What is the clinical definition of asthma in young children?

Review your knowledge of this topic and earn CPD points by taking part in MedicineToday's Online CPD Journal Program.

Log in to www.medicinetoday.com.au/cpd

Downloaded for personal use only. No other uses permitted without permission. © MedicineToday 2014.

Age-specific management of asthma in children

PETER VAN ASPEREN MB BS, MD, FRACP, F Thor Soc; **PAUL ROBINSON** MB ChB, MRCPCH, FRACP, PhD

REFERENCES

1. National Asthma Council Australia. Australian asthma handbook. Version 1.0. Melbourne: National Asthma Council Australia; 2014. Available online at: http://www.asthmahandbook.org.au (accessed August 2014).
2. Robinson PD, van Asperen P. Update in paediatric asthma management: where is evidence challenging current practice? J Paediatr Child Health 2013; 49: 346-352.
3. Robinson PD, Van Asperen P. Newer treatments in the management of paediatric asthma. Pediatr Drugs 2013; 15: 291-302.
4. British Thoracic Society (BTS), Scottish Intercollegiate Guidelines Network (SIGN). British guideline on the management of asthma. A national clinical guideline. Edinburgh: BTS/SIGN; 2008 (revised 2011). Available online at: http://www.sign.ac.uk/guidelines/fulltext/101/index.html (accessed August 2014).
5. Respiratory Expert Group, Therapeutic Guidelines Limited. Therapeutic guidelines: respiratory. Version 4. Melbourne: Therapeutic Guidelines Limited; 2009.
6. Weinberger M, Abu-Hasan M. Pseudo-asthma: when cough, wheezing, and dyspnea are not asthma. Pediatrics 2007; 120: 855-864.
7. Gibson PG, Chang AB, Glasgow NJ, et al. CICADA: cough in children and adults: diagnosis and assessment. Australian cough guidelines summary statement. Med J Aust 2010; 192: 265-271.
8. Brand PL, Baraldi E, Bisgaard H, et al. Definition, assessment and treatment of wheezing disorders in preschool children: an evidence-based approach. Eur Respir J 2008; 32: 1096-1110.
9. Konstantinou GN, Xepapadaki P, Manouusakis E, et al. Assessment of airflow limitation, airway inflammation, and symptoms during virus-induced wheezing episodes in 4- to 6-year-old children. J Allergy Clin Immunol 2013; 131: 87-93.
10. Schultz A, Devadason SG, Savenije OE, et al. The transient value of classifying preschool wheeze into episodic viral wheeze and multiple trigger wheeze. Acta Paediatr 2010; 99: 56-60.
11. Brand PLP, Caudri D, Eber E, et al. Classification and pharmacological treatment of preschool wheezing since 2008. Eur Respir J 2014; 43: 1172-1177.
12. Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention. Revised 2014. Available online at: http://www.ginasthma.org (accessed August 2014).
13. van Asperen PP, Mellis CM, Sly PD, Robertson CF. The role of corticosteroids in the management of childhood asthma. Thoracic Society of Australia and New Zealand (TSANZ) position paper. Sydney: TSANZ; 2010. Available online at: http://www.thoracic.org.au/imagesDB/wysiwyg/Steroidsinasthma_2010.pdf (accessed August 2014).
14. Chuang S, Jaffe A. Cost considerations for therapeutic options for children with asthma. Pediatr Drugs 2012; 14: 1-10.
15. van Asperen PP. Long-acting beta$_2$ agonists for childhood asthma. Aust Prescriber 2012; 35: 111-113.
16. Lemanske RF, Mauger DT, Sorkness CA, et al. Step-up therapy for children with uncontrolled asthma while receiving inhaled corticosteroids. N Engl J Med 2010; 362: 975-985.
17. Fogel RB, Rosario N, Aristizabal G, et al. Attenuation of exercise-induced bronchoconstriction with effect of montelukast or salmeterol added to inhaled fluticasone on exercise-induced bronchoconstriction in children. Ann Allergy Asthma Immunol 2010; 104: 511-517.
18. McMahon AW, Levenson MS, McEvoy BW, et al. Age and risks of FDA approved long acting beta$_2$-adrenergic receptor agonists. Pediatrics 2011; 128: e1147.
19. Lipworth BJ, Basu K, Donald HP, et al. Tailored second-line therapy in asthmatic children with the Arg16 genotype. Clin Sci 2013; 124: 521-528.
20. Jayasuriya G, Towns SJ. Asthma in adolescents: when to worry, how to navigate the challenges. Med Today 2014; 15(7): 31-39.

Downloaded for personal use only. No other uses permitted without permission. © **Medicine**Today 2014.