ABBREVIATIONS

CFC	chlorofluorocarbon
COPD	chronic obstructive pulmonary disease
COX	cyclo-oxygenase
DXA	dual-energy X-ray absorptiometry
ED	emergency department
EIB	exercise-induced bronchoconstriction
FEV_1	forced expiratory volume over one second
FEV_6	forced expiratory volume over six seconds
FSANZ	Food Standards Australia and New Zealand
FVC	forced vital capacity
GORD	gastro-oesophageal reflux disease
HFA	formulated with hydrofluroalkane propellant
ICS	inhaled corticosteroid
ICU	intensive care unit
IgE	Immunoglobulin E
IL	interleukin
IU	international units
IV	intravenous
LABA	long-acting beta$_2$-adrenergic receptor agonist
LAMA	long-acting muscarinic antagonist
LTRA	leukotriene receptor antagonist
MBS	Medical Benefits Scheme
NHMRC	National Health and Medical Research Council
NIPPV	non-invasive positive pressure ventilation
NSAIDs	nonsteroidal anti-inflammatory drugs
OCS	oral corticosteroids
OSA	obstructive sleep apnoea
PaCO	carbon dioxide partial pressure on blood gas analysis
PaO	oxygen partial pressure on blood gas analysis
PBS	Pharmaceutical Benefits Scheme
PEF	peak expiratory flow
pMDI	pressurised metered-dose inhaler or 'puffer'
PPE	personal protective equipment
SABA	short-acting beta$_2$ -adrenergic receptor agonist
SAMA	short-acting muscarinic antagonist
SaO_2	oxygen saturation
SpO_2	peripheral capillary oxygen saturation measured by pulse oximetry
TGA	Therapeutic Goods Administration

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DISCLAIMER

Studies of adults with severe asthma have identified frequently reported needs and goals, including:[3]

- achieving greater personal control over their conditions by gaining knowledge about symptoms and treatment. This included receiving more information about asthma from health professionals.
- being able to ask questions without feeling rushed during consultations
- being involved in making decisions about their treatment
- striving for a normal life.

People with severe asthma report a range of problems, including:[3, 4]

- troublesome adverse effects of oral corticosteroids (e.g. weight gain, 'puffy face', anxiety, irritability and depression) – these can affect social relationships and cause some people reduce or stop their use
- feelings of panic and fear of asthma symptoms – some people avoid activities and situations due to severe asthma
- emotional distress
- stigma
- restrictions on social life or ability to play with children
- restrictions on everyday activities including chores or leisure activities
- effects on working life, including absences or the need to change occupation or give up work
- being misunderstood by other people, who expect the person's asthma to be readily controlled as for milder asthma
- a sense of lack of support from their healthcare providers, including the perception that doctors did not have time to discuss asthma.

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Health system initiatives that support asthma care

Chronic Disease Management Medicare items

Patients with asthma are eligible for Chronic Disease Management Medicare items.[5] These include:

- Preparation of a GP Management Plan (Item 721)
- Review of a GP Management Plan (Item 732)
- Coordination of Team Care Arrangements (Item 723) for patients who need ongoing care from a multidisciplinary team of at least three health or care providers
- Coordination of a Review of Team Care Arrangements (Item 732)
- Contribution to a multidisciplinary care plan being prepared by another health or care provider (Item 729)
- Contribution to a multidisciplinary care plan being prepared for a resident of an aged care facility (Item 731).

GPs can be assisted by practice nurses, Aboriginal and Torres Strait Islander health practitioners, Aboriginal health workers and other health professionals.[5]

▶ Go to: Australian Government Department of Health's *Chronic Disease Management (CDM) Medicare Items* webpage

Asthma cycle of care

The *Asthma cycle of care* is an Australian Government initiative to support primary care health professionals (GPs, other medical practitioners and trainees) to provide asthma care. It is implemented through the *Practice Incentives Program (PIP) Asthma Incentive* and applies to the clinical care of people with moderate-to-severe asthma, generally defined as people with (any of):[6]

- symptoms on most days
- use of preventative medication
- bronchodilator use at least three times per week
- hospital attendance or admission following an acute asthma flare-up.

The *Asthma cycle of care* involves at least two asthma-related consultations within 12 months for a patient with moderate-to-severe asthma, of which at least one visit is a planned asthma review. Each consultation includes:

- documenting the diagnosis, assessing asthma severity and assessing level of recent asthma symptom control
- reviewing the patient's use of and access to asthma medicines and inhaler devices
- providing a written asthma action plan (or documented alternative, if the patient is unable to use a written action plan)
- providing asthma self-management education
- reviewing the written or documented asthma action plan.

▶ Go to: Australian Government Department of Health's *Asthma cycle of care*
Go to: Medicare's *Practice Incentive Program (PIP)*

The Personally Controlled eHealth Record System

The eHealth record is an electronic record for a patient that contains a summary of their health information. Patients can choose to register for an eHealth record. Authorised healthcare professionals can access a patient's record and upload information to the record if

their healthcare organisation has registered for the eHealth record system.

▶ Go to: Australian Government Department of Health's *eHealth Resources for Healthcare Providers*

Health system initiatives for Aboriginal and Torres Strait Islander people

Health system initiatives to support the care of Aboriginal and Torres Strait Islander people include:

- Health Assessment Medicare items
- The Indigenous Chronic Disease Package
- The Asthma Spacer Ordering System.

▶ See: *Asthma in Aboriginal and Torres Strait Islander peoples*

Assessing risk factors for adverse asthma outcomes in adults

Predicting poor asthma outcomes

As well as assessing recent asthma symptom control, it is necessary to assess each patient's risk of future asthma events or adverse treatment effects. (Recent asthma symptom control and risk of adverse events are both components of overall asthma control.)

Table. Risk factors for adverse asthma outcomes in adults and adolescents Please view and print this figure separately: http://www.asthmahandbook.org.au/table/show/40

×

Table. Risk factors for adverse asthma outcomes in adults and adolescents

Risk factors for adverse asthma outcomes in adults and adolescents

	Medical history	**Investigation findings**	**Other factors**
Factors associated with increased risk of flare-ups	Poor asthma control Any asthma flare-up during the previous 12 months Other concurrent chronic lung disease	Poor lung function (even if few symptoms) Difficulty perceiving airflow limitation or the severity of flare-ups Eosinophilic airway inflammation§	Exposure to cigarette smoke (smoking or environmental exposure) Socioeconomic disadvantage Use of illegal substances Major psychosocial problems Mental illness
Factors associated with increased risk of life-threatening asthma	Intubation or admission to intensive care unit due to asthma (ever) 2 or more hospitalisations for asthma in past year 3 or more ED visits for asthma in the past year Hospitalisation or ED visit for asthma in the past month High short-acting $beta_2$	Sensitivity to an unavoidable allergen (e.g. *Alternaria* species of common moulds)	Inadequate treatment Experience of side-effects of OCS use (may contribute to under-treatment or delayed presentation to hospital during flare-ups) Lack of written asthma action plan Socioeconomic disadvantage Living alone

	Medical history	Investigation findings	Other factors
	agonist use • Dispensing of 3 or more canisters in a year (average 1.6 puffs per day) is associated with increased risk of flare-ups in adults and children. • Dispensing 12 or more canisters in a year (average 6.6 puffs per day) is associated with increased risk of asthma death. History of delayed presentation to hospital during flare-ups History of sudden-onset acute asthma Cardiovascular disease		Mental illness Use of alcohol or illegal substances Poor access to health care (e.g. rural/remote region)
Factors associated with accelerated decline in lung function	Chronic mucus hypersecretion Severe asthma flare-up in a patient not taking ICS	Poor lung function Eosinophilic airway inflammation[§]	Exposure to cigarette smoke (smoking or environmental exposure) Occupational asthma
Factors associated with treatment-related adverse events	Long-term high-dose ICS Frequent use of OCS		Anxiety disorder (due to increased sensitivity to asthma symptoms and reluctance to reduce ICS dose when asthma well controlled) Euphoria with OCS use

§ White cell differential count on a peripheral blood sample is not currently recommended routinely in the investigation and management of asthma, but might be undertaken in the investigation of severe asthma to help guide biologic therapy.

▶ See: *Monoclonal antibody therapy*

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Table. Management of risk factors for adverse asthma outcomes in adults

Risk factor	Clinical action †
Any risk factor for flare-ups	Check patient has an appropriate action plan Carefully check inhaler technique and adherence, and identify any barriers to good adherence Review frequently (e.g. every 3 months)
Hospitalisation or ED visit for asthma or any asthma flare-up during the previous 12 months	Ask about triggers for flare-ups, and lead time
History of intubation or intensive care unit admission for asthma	Ensure action plan recommends early medical review when asthma worsens
Hospitalisation or ED visit for asthma in the past month	Emphasise importance of maintaining regular ICS use after symptoms improve Confirm that patient has resumed using SABA only when needed for symptoms
High SABA use (>3 canisters per year)	Check lung function If SABA use appears to be habitual, investigate causes and consider alternative strategies, e.g. short-term substitution of ipratropium for SABA
Long-term high-dose ICS	Consider gradual reduction of ICS dose if symptoms stable Monitor regularly (e.g. assessment of bone density, regular eye examinations) For local side-effects, ensure inhaler technique is appropriate
Poor lung function (even if few symptoms)	Consider 3-month trial of higher ICS dose, then recheck lung function Consider referral for detailed specialist investigation
Sensitivity to unavoidable allergens (e.g. **Alternaria** *species of common moulds)*	Refer for further investigation and management

Risk factor	Clinical action †
Exposure to cigarette smoke (smoking or environmental exposure)	Emphasise the importance of avoiding smoke Provide quitting strategies Consider increasing ICS dose (higher dose of ICS likely to be necessary to control asthma) Refer for assessment of asthma–COPD overlap
Difficulty perceiving airflow limitation or the severity of exacerbations	Regular PEF monitoring Action plan should recommend early review and measurement of lung function
No current written asthma action plan	Provide and explain written asthma action plan

† In addition to actions applicable to all risk factors

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Poor clinical control, as indicated by frequent asthma symptoms and frequent reliever use, is a very strong predictor of the risk of flare-ups in the future. Any asthma flare-up during the previous 12 months indicates higher risk of flare-up over the next 12 months. A history of artificial ventilation due to acute asthma, and admission to an intensive care unit due to acute asthma have been associated with increased risk of near-fatal asthma,[7] but there is not enough evidence to indicate how long this risk may persist over a person's lifetime. Other risk factors indicate increased probability of future flare-ups or accelerated decline in lung function, independent of the person's level of recent asthma symptom control.[8, 9]

Other factors may increase a person's risk of treatment-associated adverse effects. The most important of these are prescription of high dose treatment and frequent courses of oral steroids.

People with risk factors need more frequent asthma review, a carefully tailored written asthma action plan, and close attention to adherence and correct inhaler technique.

Inflammatory markers

Inflammatory markers, such as sputum eosinophil percentage or exhaled nitric oxide, are used in research and for managing severe asthma in patients attending secondary or tertiary care. Elevated sputum eosinophil levels and, to a lesser extent, elevated exhaled nitric oxide, are associated with increased risk of flare-ups. At present, treatment based on inflammatory markers is not recommended for routine use in primary care.

The value of inflammatory markers is being evaluated:

- Adjusting asthma treatment by monitoring exhaled nitric oxide does not reduce the rate of flare-ups or improve asthma control in adults and children, compared with adjusting treatment according to clinical symptoms or spirometry, based on a meta-analysis of randomised controlled clinical trials.[10] However, many of the studies were not optimally designed to answer this question,[11] and some comparator regimens did not match current recommended treatment options.
- In some studies, asthma treatment algorithms based on monitoring sputum eosinophil counts reduced flare-ups, compared with control-based management.[12, 13] However, most studies assessing treatment guided by sputum eosinophilia have been conducted in selected populations in a few research centres, and therefore may not apply to the general community population. Assessment of sputum inflammatory cells is not generally available at present even in secondary care.
- Limited evidence[14] suggests that patients whose symptoms do not match their degree of eosinophilic inflammation may benefit more from treatment monitoring using sputum eosinophil count than other patients.
- Monitoring inflammatory markers might enable safer down-titration of maintenance inhaled corticosteroid doses.

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Culturally secure asthma care for Aboriginal and Torres Strait Islander people

Primary care services can aim to deliver healthcare that is culturally secure. However, only the Aboriginal or Torres Strait Islander person themselves can determine whether their care is culturally safe or respectful.[15]

Making the healthcare system a secure environment for Aboriginal and Torres Strait Islander peoples involves cultural respect, which involves not only respecting cultural difference but recognition, protection and continued advancement of the inherent rights, cultures and traditions of Aboriginal and Torres Strait Islander peoples.[16]

Cultural awareness (or 'cultural sensitivity') among individual health professionals involves sensitivity to the similarities and differences between different cultures to enable effective communication with members of another cultural group.[17]

Training in cultural awareness and 'cultural safety' is available for non-Indigenous health professionals who provide healthcare for Aboriginal and Torres Strait Islander people.

▶ Go to: Australian College of Rural and Remote Medicine's *Cultural awareness module for PIP Indigenous Health Incentive*
Go to: RACGP's *Cultural awareness and cultural safety training*

Involvement of Aboriginal and/or Torres Strait Islander health workers and health practitioners in asthma care

Aboriginal and Torres Strait Islander health workers and Aboriginal and Torres Strait Islander health practitioners can provide self-management education for people with asthma and parents of children with asthma. Culture-specific programs may be more appropriate than mainstream programs for Aboriginal and Torres Strait Islander people.[18]

An education program (three sessions) conducted by Aboriginal and Torres Strait Islander health workers in primary health care in the Torres Strait region reduced the number of school days missed due to wheezing among school-aged children, and increased carers' knowledge of asthma, the contents of the child's written asthma action plan, and where the written asthma action plan was kept.[19] However, it did not reduce the rate of asthma flare-ups, compared with children whose families did not participate.[19]

Aboriginal and Torres Strait Islander health workers and practitioners can provide health care services that are reimbursable through Medicare.[5, 20]

Confidentiality issues for adolescents

Adolescents' concerns about confidentiality prevent them using health care services, especially if substance use is likely to be raised. Adolescents are more likely to disclose information about health risk behaviours, and are more likely to return for review, if they know that confidential information will not be revealed to their parents or others.[21]

When adolescents are accompanied by parents or carers, health care providers should consider seeing the adolescent alone for part of each consultation.[21]

Health professionals should discuss confidentiality and its limits with adolescents.[21] Adolescents are more willing to communicate honestly with healthcare professionals who discuss confidentiality with them.[22]

Health professionals need to clearly explain which personal health information can be confidential and which must be shared with parents, and keep parents informed.

Health care providers should advise adolescents that they can obtain their own Medicare card once they turn 15.[21]

▶ Go to: Royal Australasian College of Physicians' *Working with young people* online resource (see *Privacy and confidentiality in adolescent health care* in Topic 2: *Ethical and legal issues*)
Go to: Australian Government Department of Human Services' *Financial and health support for young people* webpage

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Checking whether current prescribed treatment is appropriate

▶ See also: *Severe asthma in adults and adolescents*

▶ See also: *Managing severe asthma in children aged 1–5 years*

▶ See also: *Managing difficult-to-treat and severe asthma in children aged 6 years and over*

Recommendations

Assess and record the person's level of recent asthma symptom control.

Table. Definition of levels of recent asthma symptom control in adults and adolescents (regardless of current treatment regimen)

Good control	Partial control	Poor control
All of: • **Daytime symptoms ≤2 days per week** • **Need for SABA reliever ≤2 days per week†** • **No limitation of activities** • **No symptoms during night or on waking**	**One or two of:** • **Daytime symptoms >2 days per week** • **Need for SABA reliever >2 days per week†** • **Any limitation of activities** • **Any symptoms during night or on waking**	**Three or more of:** • **Daytime symptoms >2 days per week** • **Need for SABA reliever >2 days per week†** • **Any limitation of activities** • **Any symptoms during night or on waking**

SABA: short-acting beta$_2$-agonist

† SABA, not including doses taken prophylactically before exercise. (Record this separately and take into account when assessing management.)

Note: Recent asthma symptom control is based on symptoms over the previous 4 weeks.

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Table. 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)**	**Any of:** • **Daytime symptoms† >2 days per week (lasting only a few minutes and rapidly relieved by rapid-acting bronchodilator)**	**Either of:** • **Daytime symptoms† >2 days per week (lasting from minutes to hours or recurring, and partially or fully relieved by SABA reliever)**

Good control	Partial control	Poor control
• No limitation of activities‡ • No symptoms§ during night or when wakes up • Need for SABA reliever# ≤2 days per week	• Any limitation of activities* • Any symptoms during night or when wakes up†† • Need for SABA reliever# >2 days per week	• ≥3 features of partial control within the same week

SABA: short-acting beta$_2$ agonist

† e.g. wheezing or breathing problems

‡ child is fully active; runs and plays without symptoms

§ including no coughing during sleep

 # not including doses taken prophylactically before exercise. (Record this separately and take into account when assessing management.)

*** e.g. wheeze or breathlessness during exercise, vigorous play or laughing**

†† e.g. waking with symptoms of wheezing or breathing problems

Notes:

Recent asthma control is based on symptoms over the previous 4 weeks. Each child's risk factors for future asthma outcomes should also be assessed and taken into account in management.

Validated questionnaires can be used for assessing recent symptom control:
Test for Respiratory and Asthma Control in Kids (TRACK) for children < 5 years
Childhood Asthma Control Test (C-ACT) for children aged 4–11 years

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Asset ID: 23

How this recommendation was developed

Consensus

Based on clinical experience and expert opinion (informed by evidence, where available).

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For adults, check risk factors and make sure the current treatment regimen is suitable for any risk factors identified.

Table. Risk factors for adverse asthma outcomes in adults and adolescents

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Table. Management of risk factors for adverse asthma outcomes in adults

Risk factor	Clinical action †
Any risk factor for flare-ups	**Check patient has an appropriate action plan** **Carefully check inhaler technique and adherence, and identify any barriers to good adherence** **Review frequently (e.g. every 3 months)**
Hospitalisation or ED visit for asthma or any asthma flare-up during the previous	**Ask about triggers for flare-ups, and lead time**

Risk factor	Clinical action †
12 months	
History of intubation or intensive care unit admission for asthma	**Ensure action plan recommends early medical review when asthma worsens**
Hospitalisation or ED visit for asthma in the past month	**Emphasise importance of maintaining regular ICS use after symptoms improve** **Confirm that patient has resumed using SABA only when needed for symptoms**
High SABA use (>3 canisters per year)	**Check lung function** **If SABA use appears to be habitual, investigate causes and consider alternative strategies, e.g. short-term substitution of ipratropium for SABA**
Long-term high-dose ICS	**Consider gradual reduction of ICS dose if symptoms stable** **Monitor regularly (e.g. assessment of bone density, regular eye examinations)** **For local side-effects, ensure inhaler technique is appropriate**
Poor lung function (even if few symptoms)	**Consider 3-month trial of higher ICS dose, then recheck lung function** **Consider referral for detailed specialist investigation**
Sensitivity to unavoidable allergens (e.g. **Alternaria** *species of common moulds)*	**Refer for further investigation and management**
Exposure to cigarette smoke (smoking or environmental exposure)	**Emphasise the importance of avoiding smoke** **Provide quitting strategies** **Consider increasing ICS dose (higher dose of ICS likely to be necessary to control asthma)** **Refer for assessment of asthma–COPD overlap**
Difficulty perceiving airflow limitation or the severity of exacerbations	**Regular PEF monitoring** **Action plan should recommend early review and measurement of lung function**
No current written asthma action plan	**Provide and explain written asthma action plan**

† In addition to actions applicable to all risk factors

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How this recommendation was developed

Consensus

Based on clinical experience and expert opinion (informed by evidence, where available).

Last reviewed version 2.0

Check the preventer dose that the person is currently taking.

How this recommendation was developed

Consensus

Based on clinical experience and expert opinion (informed by evidence, where available).

Last reviewed version 2.0

If the person's asthma is uncontrolled despite appropriate preventer treatment for their age, check adherence and inhaler technique carefully before optimising the treatment regimen.

▶ **See:** *Checking whether the person has problems taking their medicine*

How this recommendation was developed

Consensus

Based on clinical experience and expert opinion (informed by evidence, where available).

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More information

Classification of asthma severity and recent asthma symptom control in adults

Recent asthma symptom control

Recent asthma symptom control in adults is defined by frequency of symptoms, the degree to which symptoms affect sleep and activity, and the need for reliever medication over the previous 4 weeks.

Recent asthma symptom control is a component of overall asthma control. The other component is the risk of future events (e.g. flare-ups, life-threatening asthma, accelerated decline in lung function, or adverse effects of treatment).

Any experience of flare-ups or night-time waking due to asthma symptoms, even if infrequent, usually indicates that the person needs regular preventer treatment.

Table. Definition of levels of recent asthma symptom control in adults and adolescents (regardless of current treatment regimen)

Good control	Partial control	Poor control
All of: • Daytime symptoms ≤2 days per week • Need for SABA reliever ≤2 days per week† • No limitation of activities • No symptoms during night or on waking	One or two of: • Daytime symptoms >2 days per week • Need for SABA reliever >2 days per week† • Any limitation of activities • Any symptoms during night or on waking	Three or more of: • Daytime symptoms >2 days per week • Need for SABA reliever >2 days per week† • Any limitation of activities • Any symptoms during night or on waking

SABA: short-acting beta$_2$-agonist

† SABA, not including doses taken prophylactically before exercise. (Record this separately and take into account when assessing management.)

Note: Recent asthma symptom control is based on symptoms over the previous 4 weeks.

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Severity

Severity of asthma in adults is defined by the type and amount of treatment needed to maintain good control, not by the severity of acute flare-ups.

For patients prescribed a preventer, asthma severity can only be determined after using a preventer for at least 8 weeks and after checking adherence and inhaler technique.

▶ See: *Severe asthma in adults and adolescents*

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Classification of recent asthma symptom control in children

Ongoing review of asthma involves both assessing recent asthma symptom control and assessing risks for poor asthma outcomes such as flare-ups and adverse effects of medicines.

Recent asthma symptom control is assessed according to the frequency of asthma symptoms over the previous 4 weeks.

Table. 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 SABA 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 SABA 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 SABA reliever) • ≥3 features of partial control within the same week

SABA: short-acting beta$_2$ agonist

† e.g. wheezing or breathing problems

‡ child is fully active; runs and plays without symptoms

§ including no coughing during sleep

not including doses taken prophylactically before exercise. (Record this separately and take into account when assessing management.)

* e.g. wheeze or breathlessness during exercise, vigorous play or laughing

†† e.g. waking with symptoms of wheezing or breathing problems

Notes:

Recent asthma control is based on symptoms over the previous 4 weeks. Each child's risk factors for future asthma outcomes should also be assessed and taken into account in management.

Validated questionnaires can be used for assessing recent symptom control:
Test for Respiratory and Asthma Control in Kids (TRACK) for children < 5 years

Childhood Asthma Control Test (C-ACT) for children aged 4–11 years

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Table. Risk factors for life-threatening asthma flare-ups in children

Asthma-related factors

Poor asthma control

Admission to hospital in preceding 12 months

History of intubation for acute asthma

Over-use of short-acting beta$_2$ agonist reliever

Abnormal spirometry findings

Reversible expiratory airflow limitation on spirometry despite treatment

Poor adherence to preventer

Incorrect inhaler technique for preventer

Poor adherence to asthma action plan

Exposure to clinically relevant allergens

Exposure to tobacco smoke

Other clinical factors

Allergies to foods, insects, medicines

Obesity

Family-related factors

Frequent failure to attend consultations/lack of follow-up after an acute flare-up

Significant parental psychological or socioeconomic problems

Parent/carer unequipped to manage asthma emergency

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Asset ID: 116

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Assessing recent asthma control in adults: symptoms

Questionnaires

Questionnaire-based tools can be used to standardise review of asthma symptoms, e.g.:

- Primary care Asthma Control Screening tool (also known as Pharmacy Asthma Control Screening tool)[1] – a quick screening test to detect poor asthma control, developed and validated for use with Australian patients attending primary care
- UK Royal College of Physicians '3 Questions'[2, 3]
- Asthma Score (also known as Asthma Control Test).[4]
- *Asthma Control Questionnaire (ACQ)*

The questionnaires can be completed on paper in the waiting room and scored by the practice nurse. They have also been administered via an application on hand-held personal electronic devices, [5, 6] or by telephone.[7]

Note: Clinicians and researchers should only use the versions of the ACQ and Asthma Score that have been validated for use in the Australian population. The wording and layout of questionnaires must not be changed.

Table. Primary care Asthma Control Screening tool (PACS)

Have you experienced any of the following more than once a week in the last month?	Yes	No
Symptoms of asthma, cough, wheeze, shortness of breath	•	•

Have you experienced any of the following more than once a week in the last month?	Yes	No
Waking at night because of asthma	•	•
Chest tightness on waking	•	•
Difficulty in performing vigorous activity like running, lifting heavy objects, exercise	•	•
Difficulty in performing moderate activities like vacuuming, climbing flights of stairs	•	•

Interpretation: 'Yes' to any question indicates that the person may have poorly controlled asthma, so more detailed assessment is needed.

Source: LeMay KS, Armour CL, Reddel HK. Performance of a brief asthma control screening tool in community pharmacy: a cross-sectional and prospective longitudinal analysis. *Prim Care Respir J*; 2014. Available from: http://dx.doi.org/10.4104/pcrj.2014.00011

Asset ID: 87

Table. UK Royal College of Physicians '3 Questions' screening tool

In the last month:	Yes	No
Have you had difficulty sleeping because of your asthma symptoms (including cough)?	•	•
Have you had your usual asthma symptoms during the day (cough, wheeze, chest tightness or breathlessness)?	•	•
Has your asthma interfered with your usual activities (e.g. housework, work/school etc)?	•	•

Inerpetation:

No to all three questions indicates good control.

Yes to 2 or 3 questions indicates poor control.

Yes to 1 question indicates that more detailed questioning is needed to assess level of asthma control (using another validated questionnaire or by asking about frequency of daytime symptoms, reliever requirement, limitation of activities and symptoms at night or on waking during the previous month).

Note: This test provides a quick and easy way of confirming someone's asthma control is good, or identifying those who need more assessments.

Sources

Thomas M, Gruffydd-Jones K, Stonham C *et al.* Assessing asthma control in routine clinical practice: use of the Royal College of Physicians '3 Questions'. *Prim Care Respir J* 2009; 18: 83-8. Available from: http://www.nature.com/articles/pcrj200845

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Asset ID: 37

▶ See: *Asthma Score*

Symptom-guided management

Data from one UK study suggest that, for the majority of patients attending primary care, asthma symptoms are concordant with eosinophilic airway inflammation, and that symptoms can therefore be used as a guide to changing anti-inflammatory treatment.[8]

However, if symptoms do not improve as expected after a change in treatment, or if the person continues to experience flare-ups, it is necessary to measure lung function and consider other possible causes:

- Respiratory symptoms in a person with asthma may be due to non-asthma factors (e.g. cough due to post-nasal drip, shortness of breath due to obesity). Increasing the preventer treatment in such patients could result in unnecessarily high doses. A careful history (with lung function measurement in some patients) is necessary to confirm that symptoms are due to asthma, before deciding to change a person's treatment.
- Patients vary in their ability to perceive airflow limitation, so symptoms may be an unreliable measure of asthma control in some patients. Spirometry can help identify if the person is a poor perceiver of airflow limitation (e.g. person is unable to feel the difference when FEV_1 increases or decreases by 15%).

▶ See: *Diagnosing asthma in adults*

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Assessing asthma control in adults: spirometry

Spirometry is necessary when making the diagnosis of asthma and when establishing the patient's baseline and personal best status.

In ongoing asthma management, spirometry is useful in the following clinical situations:

- During a flare-up, spirometry provides objective evidence about the severity of bronchoconstriction.
- After a dose adjustment (either an increase or a decrease), change in lung function measured by spirometry provides additional information about the response to treatment.
- Spirometry can help identify if the person's symptoms may be due to non-asthma conditions (e.g. for a patient with frequent respiratory symptoms, FEV_1 above 80–90% predicted should prompt consideration of an alternative cause).
- Spirometry can help identify if the person is a poor perceiver of airflow limitation (e.g. person is unable to feel the difference when FEV_1 increases or decreases by 15%).
- Repeating spirometry over time may identify lung function decline that is more rapid than expected decline due to ageing alone, so the person can be referred for specialist review. (Spirometry should be repeated approximately every 1–2 years in most patients but more frequently as indicated by individual needs.)

There are limits to the amount of information that can be gained from spirometry alone:

- For an individual, spirometry readings are not closely reproducible between visits, so only a change in FEV_1 of greater than 0.2 L and 12% from baseline can be considered clinically meaningful in adults.[9]
- Older people with long-standing asthma may develop fixed (irreversible or incompletely reversible) airflow limitation. Reliance solely on lung function expressed as percentage predicted value as a guide to adjusting preventer treatment would risk dose-escalation and over-treatment in these patients.
- At the population level, spirometry correlates poorly with symptom-based measures of asthma control,[10] so in individual patients it is not possible to predict lung function from symptoms or vice versa.

To obtain reliable, good-quality readings, the spirometer must be well maintained and correctly calibrated, and the operator must be adequately trained and experienced.

▶ Go to: National Asthma Council Australia's *Spirometry Resources*

Assessing risk factors for adverse asthma outcomes in adults

Predicting poor asthma outcomes

As well as assessing recent asthma symptom control, it is necessary to assess each patient's risk of future asthma events or adverse treatment effects. (Recent asthma symptom control and risk of adverse events are both components of overall asthma control.)

Table. Risk factors for adverse asthma outcomes in adults and adolescents Please view and print this figure separately: http://www.asthmahandbook.org.au/table/show/40

×

Table. Risk factors for adverse asthma outcomes in adults and adolescents

Risk factors for adverse asthma outcomes in adults and adolescents

§ White cell differential count on a peripheral blood sample is not currently recommended routinely in the investigation and

	Medical history	**Investigation findings**	**Other factors**
Factors associated with increased risk of flare-ups	Poor asthma control Any asthma flare-up during the previous 12 months Other concurrent chronic lung disease	Poor lung function (even if few symptoms) Difficulty perceiving airflow limitation or the severity of flare-ups Eosinophilic airway inflammation[§]	Exposure to cigarette smoke (smoking or environmental exposure) Socioeconomic disadvantage Use of illegal substances Major psychosocial problems Mental illness
Factors associated with increased risk of life-threatening asthma	Intubation or admission to intensive care unit due to asthma (ever) 2 or more hospitalisations for asthma in past year 3 or more ED visits for asthma in the past year Hospitalisation or ED visit for asthma in the past month High short-acting beta$_2$ agonist use • Dispensing of 3 or more canisters in a year (average 1.6 puffs per day) is associated with increased risk of flare-ups in adults and children. • Dispensing 12 or more canisters in a year (average 6.6 puffs per day) is associated with increased risk of asthma death. History of delayed presentation to hospital during flare-ups History of sudden-onset	Sensitivity to an unavoidable allergen (e.g. *Alternaria* species of common moulds)	Inadequate treatment Experience of side-effects of OCS use (may contribute to under-treatment or delayed presentation to hospital during flare-ups) Lack of written asthma action plan Socioeconomic disadvantage Living alone Mental illness Use of alcohol or illegal substances Poor access to health care (e.g. rural/remote region)

	Medical history	Investigation findings	Other factors
	acute asthma Cardiovascular disease		
Factors associated with accelerated decline in lung function	Chronic mucus hypersecretion Severe asthma flare-up in a patient not taking ICS	Poor lung function Eosinophilic airway inflammation[§]	Exposure to cigarette smoke (smoking or environmental exposure) Occupational asthma
Factors associated with treatment-related adverse events	Long-term high-dose ICS Frequent use of OCS		Anxiety disorder (due to increased sensitivity to asthma symptoms and reluctance to reduce ICS dose when asthma well controlled) Euphoria with OCS use

management of asthma, but might be undertaken in the investigation of severe asthma to help guide biologic therapy.

▶ See: *Monoclonal antibody therapy*

Sources

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Table. Management of risk factors for adverse asthma outcomes in adults

Risk factor	Clinical action †
Any risk factor for flare-ups	Check patient has an appropriate action plan Carefully check inhaler technique and adherence, and identify any barriers to good adherence Review frequently (e.g. every 3 months)

Risk factor	Clinical action †
Hospitalisation or ED visit for asthma or any asthma flare-up during the previous 12 months	Ask about triggers for flare-ups, and lead time
History of intubation or intensive care unit admission for asthma	Ensure action plan recommends early medical review when asthma worsens
Hospitalisation or ED visit for asthma in the past month	Emphasise importance of maintaining regular ICS use after symptoms improve Confirm that patient has resumed using SABA only when needed for symptoms
High SABA use (>3 canisters per year)	Check lung function If SABA use appears to be habitual, investigate causes and consider alternative strategies, e.g. short-term substitution of ipratropium for SABA
Long-term high-dose ICS	Consider gradual reduction of ICS dose if symptoms stable Monitor regularly (e.g. assessment of bone density, regular eye examinations) For local side-effects, ensure inhaler technique is appropriate
Poor lung function (even if few symptoms)	Consider 3-month trial of higher ICS dose, then recheck lung function Consider referral for detailed specialist investigation
Sensitivity to unavoidable allergens (e.g. **Alternaria** *species of common moulds)*	Refer for further investigation and management
Exposure to cigarette smoke (smoking or environmental exposure)	Emphasise the importance of avoiding smoke Provide quitting strategies Consider increasing ICS dose (higher dose of ICS likely to be necessary to control asthma) Refer for assessment of asthma–COPD overlap
Difficulty perceiving airflow limitation or the severity of exacerbations	Regular PEF monitoring Action plan should recommend early review and measurement of lung function
No current written asthma action plan	Provide and explain written asthma action plan

† In addition to actions applicable to all risk factors

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Poor clinical control, as indicated by frequent asthma symptoms and frequent reliever use, is a very strong predictor of the risk of flare-ups in the future. Any asthma flare-up during the previous 12 months indicates higher risk of flare-up over the next 12 months. A history of artificial ventilation due to acute asthma, and admission to an intensive care unit due to acute asthma have been associated with increased risk of near-fatal asthma,[11] but there is not enough evidence to indicate how long this risk may persist over a person's lifetime. Other risk factors indicate increased probability of future flare-ups or accelerated decline in lung function, independent of the person's level of recent asthma symptom control.[4, 12]

Other factors may increase a person's risk of treatment-associated adverse effects. The most important of these are prescription of high dose treatment and frequent courses of oral steroids.

People with risk factors need more frequent asthma review, a carefully tailored written asthma action plan, and close attention to adherence and correct inhaler technique.

Inflammatory markers

Inflammatory markers, such as sputum eosinophil percentage or exhaled nitric oxide, are used in research and for managing severe asthma in patients attending secondary or tertiary care. Elevated sputum eosinophil levels and, to a lesser extent, elevated exhaled nitric oxide, are associated with increased risk of flare-ups. At present, treatment based on inflammatory markers is not recommended for routine use in primary care.

The value of inflammatory markers is being evaluated:

- Adjusting asthma treatment by monitoring exhaled nitric oxide does not reduce the rate of flare-ups or improve asthma control in adults and children, compared with adjusting treatment according to clinical symptoms or spirometry, based on a meta-analysis of randomised controlled clinical trials.[13] However, many of the studies were not optimally designed to answer this question,[14] and some comparator regimens did not match current recommended treatment options.
- In some studies, asthma treatment algorithms based on monitoring sputum eosinophil counts reduced flare-ups, compared with control-based management.[15, 16] However, most studies assessing treatment guided by sputum eosinophilia have been conducted in selected populations in a few research centres, and therefore may not apply to the general community population. Assessment of sputum inflammatory cells is not generally available at present even in secondary care.
- Limited evidence[8] suggests that patients whose symptoms do not match their degree of eosinophilic inflammation may benefit more from treatment monitoring using sputum eosinophil count than other patients.
- Monitoring inflammatory markers might enable safer down-titration of maintenance inhaled corticosteroid doses.

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Approaches to assessment and monitoring of asthma control in children

Assessment of asthma control in children is based mainly on:

- recent asthma symptom control (assessed by the frequency and severity of symptoms between flare-ups
- the degree to which asthma symptoms affect daily activities such as interference with physical activity or missed school days)
- the frequency of flare-ups
- spirometry in children who are able to perform the test reliably.

Standardised questionnaires

Questionnaire-based instruments have been validated for assessing asthma control in children:

- *Test for Respiratory and Asthma Control in Kids (TRACK)* for children less than 5 years old – consists of five questions about frequency of respiratory symptoms (wheeze, cough, shortness of breath), activity limitation, and night-time awakenings in the past 4 weeks, rescue medication use in the past 3 months, and oral corticosteroid use in the previous year.[17, 18] A lower score indicates worse asthma control.

  Childhood Asthma Control Test (C-ACT) for children aged 4–11 years – consists of seven items: three for the parent/carer (about the child's symptoms over the previous 4 weeks) and four for the child.[19, 20] A lower score indicates worse asthma control. **Note:** C-ACT is intended for US use.

Lung function tests

Frequent spirometry to guide asthma treatment in children has not been shown to achieve superior outcomes to symptom-based treatment.[REFERENCE1739] Current evidence does not support use of home spirometers to guide asthma treatment in children.[22] However, low FEV_1 predicts clinically significant flare-ups, so spirometry should be performed at asthma reviews for children who are old enough to do the test.
The quality and utility of spirometry depends on the skill, clinical expertise and experience of the person doing and interpreting spirometry.

The results of one study in children aged 6–16 years with moderate atopic asthma suggest that asthma treatment guided by airway

hyperresponsiveness (measured by bronchial provocation testing) may have a benefit over symptom-guided treatment in improving lung, but this effect was lost after 3–7 years of usual care.[23, 24] Repeated bronchial provocation testing is not feasible in clinical practice.

Measures of airway inflammation

Measures of airway inflammation (e.g. sputum eosinophil count, exhaled nitric oxide measurement) are not recommended in primary care to guide treatment decisions, but are increasingly used in specialist clinics.

Asthma treatment guided by sputum eosinophil count has been shown to reduce the frequency of flare-ups in adults with asthma, but there is insufficient evidence to ascertain its value for children.[25]

Exhaled nitric oxide measurement may be useful in guiding asthma management in some children. In children not taking inhaled corticosteroid, a high nitric oxide level probably predicts a good short-term response to inhaled corticosteroid treatment,[26] but it does not distinguish between asthma and eosinophilic bronchitis and is often high in children with atopy. There is insufficient evidence to ascertain whether a low exhaled nitric oxide level predicts successful withdrawal from inhaled corticosteroids without asthma relapse,[26] or safety of treating asthma without inhaled corticosteroids.

A Cochrane review[27] found that exhaled nitric oxide-guided management was significantly better than other approaches to adjusting medicines for reducing the number of children with flare-ups and the number of children who needed oral corticosteroids, but did not reduce the frequency of flare-ups or the rate of flare-ups requiring hospitalisation, improve lung function or symptoms scores, or reduce inhaled corticosteroid doses. The authors concluded that it could not be recommended for all children but may be beneficial for a subset not yet defined.[27]

Towards personalised asthma care

Emerging understanding of asthma phenotypes and of genetic factors that predict therapeutic response to preventer options is leading to the possibility of personalised, genomics-based treatment for asthma in children.[28] In the near future, individual tailored therapy is may replace the standardised step model based on population data.

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Written asthma action plans for adults

Every person with asthma should have their own written asthma action plan.

When provided with appropriate self-management education, self-monitoring and medical review, individualised written action plans consistently improve asthma health outcomes if they include two to four action points, and provide instructions for use of both inhaled corticosteroid and oral corticosteroids for treatment of flare-ups.[29] Written asthma action plans are effective if based on symptoms[30] or personal best peak expiratory flow (not on percentage predicted).[29]

How to develop and review a written asthma action plan

A written asthma action plan should include all the following:

- a list of the person's usual medicines (names of medicines, doses, when to take each dose) – including treatment for related conditions such as allergic rhinitis
- clear instructions on how to change medication (including when and how to start a course of oral corticosteroids) in all the following situations:
  - when asthma is getting worse (e.g. when needing more reliever than usual, waking up with asthma, more symptoms than usual, asthma is interfering with usual activities)
  - when asthma symptoms get substantially worse (e.g. when needing reliever again within 3 hours, experiencing increasing difficulty breathing, waking often at night with asthma symptoms)
  - when peak flow falls below an agreed rate (for those monitoring peak flow each day)
  - during an asthma emergency.
- instructions on when and how to get medical care (including contact telephone numbers)
- the name of the person writing the action plan, and the date it was issued.

Table. Options for adjusting medicines in a written asthma action plan for adults

Please view and print this figure separately: http://www.asthmahandbook.org.au/table/show/42

Table. Checklist for reviewing a written asthma action plan

- Ask if the person (or parent) knows where their written asthma action plan is.
- Ask if they have used their written asthma action plan because of worsening asthma.
- Ask if the person (or parent) has had any problems using their written asthma action plan, or has any comments about whether they find it suitable and effective.

- Check that the medication recommendations are appropriate to the person's current treatment.
- Check that all action points are appropriate to the person's level of recent asthma symptom control.
- Check that the person (or parent) understands and is satisfied with the action points.
- If the written asthma action plan has been used because of worsening asthma more than once in the past 12 months: review the person's usual asthma treatment, adherence, inhaler technique, and exposure to avoidable trigger factors.
- Check that the contact details for medical care and acute care are up to date.

Asset ID: 43

Templates for written asthma action plans

Templates are available from National Asthma Council Australia:

- National Asthma Council Australia colour-coded plan, available as a printed handout that folds to wallet size and as the *Asthma Buddy* mobile site
- Asthma Cycle of Care asthma action plan
- A plan designed for patients using budesonide/formoterol combination as maintenance and reliever therapy
- Remote Indigenous Australian Asthma Action Plan
- Every Day Asthma Action Plan (designed for remote Indigenous Australians who do not use written English – may also be useful for others for whom written English is inappropriate).

Some written asthma action plans are available in community languages.

Software for developing electronic pictorial asthma action plans[31, 32] is available online.

▶ Go to: National Asthma Council Australia's *Asthma Action Plan Library*
Download: Imperial College London's *Electronic Asthma Action Plan*

Written asthma action plans for children

Every child with asthma should have their own written asthma action plan.

A systematic review found that the use of written asthma action plans significantly reduces the rate of visits to acute care facilities, the number of school days missed and night-time waking, and improves symptoms.[33]

For children and adolescents, written asthma action plans that are based on symptoms appear to be more effective than action plans based on peak expiratory flow monitoring.[33]

A written asthma action plan should include all the following:

- a list of the child's usual medicines (names of medicines, doses, when to take each dose) – including treatment for related conditions such as allergic rhinitis
- clear instructions on what to do in all the following situations:
  - when asthma is getting worse (e.g. when needing more reliever than usual, waking up with asthma, more symptoms than usual, asthma is interfering with usual activities)
  - when asthma symptoms get substantially worse (e.g. when needing reliever again within 3 hours, experiencing increasing difficulty breathing, waking often at night with asthma symptoms)
  - during an asthma emergency.
- instructions on when and how to get medical care (including contact telephone numbers)
- the name and contact details of the child's emergency contact person (e.g. parent)
- the name of the person writing the action plan, and the date it was issued.

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- Ask if the person (or parent) knows where their written asthma action plan is.
- Ask if they have used their written asthma action plan because of worsening asthma.
- Ask if the person (or parent) has had any problems using their written asthma action plan, or has any comments about whether they find it suitable and effective.
- Check that the medication recommendations are appropriate to the person's current treatment.
- Check that all action points are appropriate to the person's level of recent asthma symptom control.
- Check that the person (or parent) understands and is satisfied with the action points.
- If the written asthma action plan has been used because of worsening asthma more than once in the past 12 months: review the person's usual asthma treatment, adherence, inhaler technique, and exposure to avoidable trigger factors.
- Check that the contact details for medical care and acute care are up to date.

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- A plan designed for patients using budesonide/formoterol combination as maintenance and reliever therapy
- Remote Indigenous Australian Asthma Action Plan
- Every Day Asthma Action Plan (designed for remote Indigenous Australians who do not use written English – may also be useful for others for whom written English is inappropriate)
- Children's written asthma action plans.

Some written asthma action plans are available in community languages.

Software for developing electronic pictorial asthma action plans[31, 32] is available online.

▶ Go to: National Asthma Council Australia's *Asthma Action Plan Library*

Download: Imperial College London's *Electronic Asthma Action Plan*

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What is severe asthma?

Definitions

Severe asthma is asthma that remains uncontrolled despite high-dose inhaled corticosteroids plus long-acting beta$_2$ agonist (with correct inhaler technique and good adherence) or maintenance oral corticosteroids, or that requires such treatment to prevent it becoming uncontrolled.[34]

Severe asthma is sometimes also called 'severe refractory asthma' or 'severe treatment-resistant asthma'. However, the introduction of monoclonal antibody therapies has demonstrated that significant improvements can be seen in asthma that was previously termed 'refractory'.

Asthma is considered to be uncontrolled if any of the following are identified:

- poor symptom control, e.g. during previous 4 weeks any of:
  - symptoms during night or on waking
  - limitation of activities due to asthma
  - daytime symptoms on more than 2 days per week
  - need for short-acting beta$_2$ agonist reliever on more than 2 days per week (not including doses taken prophylactically before exercise).
- frequent severe flare-ups (e.g. more than one flare-up requiring treatment with oral corticosteroids in the previous year)
- serious flare-ups (e.g. hospital admission, intensive care unit admission, or mechanical ventilation in the previous year)
- persistent airflow limitation (e.g. detected by spirometry).

Patients with severe asthma are a subgroup of those with difficult-to-treat asthma. Difficult-to-treat asthma is defined as asthma that remains uncontrolled despite treatment with a high dose of an inhaled corticosteroid combined with a long-acting beta$_2$ agonist.

Not all patients with difficult-to-treat asthma have severe asthma. Difficult-to-treat asthma includes asthma that is uncontrolled due to suboptimal adherence, inappropriate or incorrect use of medicines, environmental triggers or comorbidities. Patients whose asthma control improves rapidly after such problems are corrected are not considered to have severe asthma.[34]

Prevalence

Severe asthma is uncommon. Less than 4% of adults with asthma have severe asthma.[35]

Description

Severe asthma appears to be a distinct disease (or group of diseases) with different pathobiology from that of milder forms of asthma. It is rare for mild asthma to progress to severe asthma.[36]

Severe asthma imposes a high burden of disease due to symptoms, flare-ups, medication-related adverse effects and costs.[37, 38]

Bronchiectasis, granulomas and other auto-immune disease processes can coexist with severe asthma.[36, 39] Aspirin-exacerbated respiratory disease can present as severe asthma.

Patterns of airway inflammation vary among people with severe asthma,[40] which suggests that the underlying pathophysiology varies.

Inflammatory patterns identified in adults in research studies include eosinophilic (elevated sputum eosinophil count), neutrophilic (elevated sputum neutrophil count), mixed (elevated sputum eosinophil and neutrophil counts) and paucigranulocytic (sputum eosinophil and neutrophil counts within normal range).[41] However, these tests are not routinely available in practice to guide treatment.

Some patients with severe asthma show sustained eosinophilia on blood tests despite good adherence to treatment with high doses of inhaled corticosteroids[36, 42]

Current research aims to predict which treatments will be most effective in an individual according to the findings of a range clinical investigations (e.g. sputum cell counts, peripheral blood white cell counts, fraction of exhaled nitric oxide [FeNO]) and on other clinical features such as age of asthma onset, relationship of allergies to asthma symptoms or presence of nasal polyposis. Few studies have been conducted to identify severe asthma phenotypes among children with severe asthma.[40]

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Common reasons for poor response to preventer treatment

Apparent lack of response to asthma treatment is commonly due to one or more of the following:[43]

- poor adherence (which may be due to lack of perceived need for the medication, concern about potential or actual side-effects, cost of medicines, a busy lifestyle, misunderstanding of the purpose and effects of asthma medicines, or inability to follow the medical instructions)
- poor inhaler technique
- mishandling devices (e.g. failure to clean spacer, allowing mouthpiece of dry-powder inhalers to become blocked)
- incorrect dose or frequency
- empty inhaler
- expired medicines
- continued exposure to smoke or allergen triggers.

Failure to identify these causes before adjusting medicines could result in over-medication with preventers.

▶ See: *Management challenges*

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