Asthma control in adults

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The prevalence of asthma has increased in most countries since the 1970s. Levels may have plateaued in developed countries but as prevalence is associated with urbanisation and a western lifestyle the problem worldwide is likely to increase over the next two decades (fig 1). About 300 million people worldwide have asthma and by 2025 it has been estimated that a further 100 million will be affected.¹ Asthma accounts for one in every 250 deaths worldwide and 1% of all disability adjusted life years. In overall health terms chronic symptoms of asthma account for 8% of self reported poor health in 18-64 year olds and 3.5% of days of limited activity, putting asthma above diabetes but below arthritis as a chronic health problem.^{w1} Psychological distress and feelings of decreased control are high in people with asthma and strongly associated with physical health.^{w2} Well controlled asthma reduces the burden for patients and health services.

Control of asthma may mean minimal symptoms and freedom from exacerbations for patients, normal peak flow or low scores on standard questionnaires for doctors, or composite measures in clinical trials. As definitions vary an American Thoracic Society taskforce is considering standard definitions for control and exacerbations.^{w3} This review looks at important issues in definition and control of asthma in adults.

Sources and selection criteria

I searched Medline for articles on asthma in adults using the terms "asthma control" for 2004-6. I also searched Cochrane reviews, hand searched reference lists and conference proceedings, and discussed important current issues in asthma control with colleagues.

How do asthma guidelines define control?

Control is usually defined by severity of symptoms, simple tests such as peak expiratory flow, and prevention of exacerbations. Current guidelines suggest that most patients with asthma can have complete control and live a normal life unrestricted by symptoms or side effects of treatment. The global initiative for asthma (www.ginasthma.com/) states that:

Fortunately asthma can be treated and controlled so that almost all patients can prevent troublesome symptoms night and day; prevent serious attacks; require little or no reliever drugs; have productive, physically active lives; and have (near) normal lung function

Summary points

Good control of asthma is desirable for short term gains and probably for longer term outcomes in asthma

The approach to control needs to take account of patients' own aims and expectations for their asthma

Adjusting therapy based on measures of underlying airway inflammation can produce better control with less therapy, at least in clinical trials

Further studies are needed to assess the best way to use such techniques and to link them to the control of patients in the real world outside clinical trials

Long acting β agonists should not be used without inhaled corticosteroids in asthma

Different approaches to treatment and control may suit different patients, but simple, personalised management plans improve control

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Symptoms are also used to define levels of severity in the global initiative for asthma guidelines (table). Guidelines acknowledge that in individual patient criteria for adequate control depend on personal aims and expectations²:

It is not appropriate to define a fixed level of lung function or symptom control which must be achieved, as individual patients will have different goals and may also wish to balance these aims against the potential side-effects or inconvenience of taking the medication necessary to achieve perfect control

Is good control being achieved?

Although many clinical trials³ have shown that good control can be achieved in most patients this is not the situation in most audits of large groups in real life out-side trials. In a recent European study 82% of patients reported lack of control of their asthma and most had

Asthma control test, appendix, and references w1-w35 are on bmj.com

Fig 1 Prevalence of clinical asthma worldwide. Reproduced from Masoli et al¹ with permission of Blackwell

their lifestyle restricted.^{w4} Although 94% said they would like to live without asthma symptoms, 90% expected to have symptoms as part of their asthma. In a US study nearly three quarters of 60 000 patients showed lack of control and over three quarters had their activities limited in the previous week.⁴ So although it is possible to achieve good control in asthma and patients would prefer to be symptom free, this is not being achieved. Part of this failure may be low expectations of patients and doctors.

How to measure control

Regular monitoring of peak flow provides a simple objective evaluation of airway narrowing but only improves outcomes in asthma when combined with monitoring of symptoms in a personalised management plan.^{w5} Some patients have a poor perception of airway narrowing,^{w6} so peak flow measurement is then a more important measure of control. Recognition of airway narrowing may be reduced by persistent inflammation of the airways in unstable asthma, increasing susceptibility to exacerbations.^{w7}

In clinical practice asking patients about control of symptoms and the effects of asthma on everyday life are important in understanding the patient's perception of control and exploring their attitude to their asthma. However, current health records often do not contain adequate information to establish whether control is being achieved.^{w8} Questionnaires have been developed to produce a standard approach to assessment of symptom control. The Royal College of

Box 1 Questions produced by Royal College of Physicians on asthma control in past week or month

- Have you had difficulty sleeping because of 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 normal activities (for example, housework, work, school)?

Physicians have devised three questions (box 1) recommended as an audit tool by the British Thoracic Society and Scottish Intercollegiate Guidelines Network.² They provide a simple monitor although they may not be sufficiently patient centred and may be subject to recall bias.⁵

The questions are simple and have been incorporated into other measures.^{w9-w11} In clinical trials more complex evaluations of quality of life have been used to assess control. The asthma quality of life questionnaire^{w12} was developed for adults to measure functional impairment. It contains 32 items in the four domains of symptoms, emotions, exposure to environmental stimuli, and activity limitation.

A shorter, self administered 15 item version, the mini asthma quality of life questionnaire,^{w13} covers physical and emotional problems. The seven item asthma control questionnaire^{w14 w15} with five symptoms, rescue bronchodilator use, and percentage predicted forced expiratory volume in one second, looks for the degree of control recommended in international asthma guidelines (see appendix on bmj.com). Trials may combine measurements to look at asthma-free days or asthma-free weeks.

Control of airway inflammation

Even when asthma seems well controlled, biopsy samples of the bronchial mucosa show widespread inflammation, which can be influenced by treatment.^{6 w16} A practical measure of this inflammation might allow asthma treatment to be closely matched to a different concept of control of the disease process.

This approach requires a simple, cheap, and repeatable measure of inflammation. This rules out techniques that involve bronchial biopsy or lavage (fig 2), airway responsiveness,⁷ or eosinophilia identified in

Classification of asthma severity according to symptoms on basis of global initiative for asthma guidelines

Frequency of asthma symptoms	Intermittent	Mild persistent	Moderate persistent	Severe persistent
Daytime	<2 times/week	≥2 times/week	Every day (≤2 times/day)	3 times daily
Night time	2 times/month	≥2 times/month	≥2 times/week	Most nights
Severe episodes in past 12 months	≤1 time/week	≥2 times/week	Every day	Every day
Exercise induced symptoms in past 12 months	≤1 time/week	≥2 times/week	Every day	Every day
Symptom frequency in typical week	≤2 times	3-6 times	7-20 times	8-21 times

Fig 2 Eosinophils in bronchial mucosa, part of inflammatory process in asthma

Fig 3 Formation and action of nitric oxide in airways

sputum,⁸ which have been shown to reduce both exacerbations and therapy. Studies of exhaled breath are simpler, and monitoring nitric oxide (fig 3) may be more promising,⁹ allowing less treatment without worsening control (fig 4).¹⁰ The usefulness of nitric oxide monitoring in routine clinical practice is, however, unproved.

Are there benefits of effective long term control?

Control of symptoms produces short term benefits to patients, and suppression of inflammation reduces symptoms, exacerbations, and the need for extra therapy. The hope is that prolonged control of airway inflammation will reduce the likelihood of airway remodelling with progression of reversible airflow obstruction to irreversibility. The evidence to support this concept is growing but circumstantial and needs long term controlled studies.¹⁷ Observational studies suggest that delays to the introduction of anti-inflammatory treatments may result in lower lung function.¹⁸ Trials to establish the benefit of adequate suppression of inflammation in the airway wall are likely to be easier with simpler monitors of underlying inflammation.

Which drugs to use for control?

Most patients with asthma need drugs to control their asthma. Inhaled corticosteroids are generally the most effective drugs in adults with asthma,¹⁹ and they remain the mainstay of regular treatment in chronic asthma (www.ginasthma.com/).^{2 11} Leukotriene receptor antagonists can be a useful alternative for patients unable or unwilling to take inhaled corticosteroids and have an additive effect to low or moderate dose inhaled corticosteroids.¹² Phosphodiesterase 4 inhibitors provide another alternative.²⁰ Long acting β agonists are generally used as first choice add on therapy for patients who do not achieve control with low to moderate dose inhaled corticosteroids.^{13 14 21} Concerns have been expressed about the place of long acting

β agonists, particularly after the recent salmeterol multicentre asthma research trial study that showed increased exacerbations and death rates in patients taking salmeterol.¹⁵ Subgroup analysis showed no significant increase in death rates in those taking inhaled corticosteroids,¹⁶ emphasising the importance of only using long acting β agonists in combination with inhaled corticosteroids in asthma.²²

Inhaled corticosteroids are available in a great variety of preparations and doses. Most of the effect is achieved at low to moderate doses, equivalent to 400 μ g beclomethasone dipropionate.²³ Although further benefit is obtained from higher doses in severe asthma,²⁴ most adults with asthma are controlled with doses that minimise possible adverse effects. Two commonly used drugs, beclomethasone and budesonide, seem to have equivalent effects at the same dose, whereas fluticasone propionate is around twice as potent.¹⁷

It was common practice for patients to start inhaled corticosteroids at a high dose to establish control, but this seems to be unnecessary as low to moderate starting doses are usually appropriate.¹⁸ In patients with coexistent rhinitis, the combination of inhaled corticosteroids and nasal steroids may provide better asthma control.²⁵

Implications for treatment strategies

Both inhaled corticosteroids and long acting β agonists are usually taken twice daily. It is therefore convenient to combine them in an inhaler, so that long acting β agonists cannot be used alone. Two approaches are being put forward. One suggestion is to use sufficient doses to produce complete suppression of symptoms, aiming for long periods of stable control. This approach is characterised by the gaining optimal asthma control study, which achieved control in 71% of patients.³

The other approach seeks to vary the doses in response to symptoms, as many patients do in practice. Doubling inhaled steroids may not be enough.¹⁹ Recent studies have quadrupled doses when control deteriorates, reducing the dose quickly when symptoms are controlled. This approach involves the patient in a more active management plan and has achieved better control with fewer exacerbations and fewer

Fig 4 Exhaled nitric oxide can be used to establish better control using lower doses of inhaled corticosteroids. Trial arms were asthma controlled on basis of exhaled nitric oxide and usual criteria (control group). Bars represent standard deviations. Reproduced from Smith et al¹⁰ with permission of Massachusetts Medical Society

Box 2 Predictors of poor adherence to asthma treatment. Adapted from Osterberg and Blaschke²²

Factors that are difficult or impossible to alter

- Psychological problems
- Cognitive impairment
- Asymptomatic disease (good control)
- Disease duration
- Cost of treatment

Patient issues

- Missed appointments

Doctor or joint issues

- Inadequate follow-up or discharge planning
- Side effects of drugs or worries about such effects
- Lack of belief in treatment
- Lack of insight in to illness
- Poor patient-provider relationship
- Barriers to care and treatment
- Complexity of treatment

Additional educational resources

British Thoracic Society (www.brit-thoracic.org.uk/iqs/sid.00404940967412532509065/)

Guidelines since 201997_asthma.html)—guidelines on the management of asthma produced by the British Thoracic Society/Scottish Intercollegiate Guidelines Network

Lung and asthma information agency (www.laia.ac.uk/)—useful factsheets and charts of respiratory and allergic disease epidemiology

Global initiative for asthma (www.ginasthma.com/)—updated guidelines and other resources on the management of asthma, and details of world asthma day (2 May 2006)

Information for patients

Asthma UK (www.asthma.org.uk/using_your.html)—animated sequences on use of all common inhalers

Asthma UK (www.asthma.org.uk/all_about_asthma/publications/index.html)—provides details of a free “be in control” pack, with asthma review card, peak flow diary, personal asthma action plan, and medicine card

inhaled corticosteroids in some studies^{20 w26} but not others.²¹ Clinical trials require a change in symptoms for 24–48 hours and it may be even more effective for patients to change treatment sooner.

Either of these approaches can be recommended and may suit patients^{w27} who want to actively control their management and minimise therapy or who want to suppress their asthma with little change unless an exacerbation breaks through. A minority will remain difficult to control with either approach.

Adherence

Over the past 10 years more attention has been paid to adherence to therapy. If satisfactory control is achieved, symptoms stop acting as a reminder to take treatment. Several factors have been related to compliance with therapy^{w28}:

- Patient's treatment goals
- Patient's beliefs about therapy
- Social and economic factors
- Administration route of therapy
- Device chosen
- Concern about side effects

The patient's aims in treatment need to be taken in to account in establishing an agreed approach to asthma management. Box 2 shows predictors of poor adherence to treatment.

In practice, patients show many different patterns of adherence.²² Adherence may be a particular issue with inhaled corticosteroids used alone, when the patient feels no immediate benefit. In the future it is likely that appropriate interventions such as cognitive behavioural therapy will be available to target adherence in particular patients, although as yet evidence is lacking to support any particular intervention.²³ Inhaler technique should be checked regularly.

Management plans

Guidelines indicate the importance of management plans in asthma control. A combination of education, review by health practitioners, and a written self management plan improve asthma outcomes.^{w29} Although it is uncertain which particular components of the plan are most important²⁴ personalisation and simplicity with 2–4 action points are important.^{w30} This approach is especially useful in vulnerable groups such as high risk patients^{w31} and those from a deprived multiethnic environment.^{w32} The plans can give patients control of their asthma and increase adherence to regular treatment.^{w33}

Material to help patients understand and assess control of their asthma is available from organisations such as Asthma UK (fig 5).

Further advances in monitoring may come through technology. Using portable digital assistants can prompt assessment such as peak flow and administration of routine therapy as well as storing and supplying management plans. Mobile telephones have been used to report symptoms and to get feedback on the appropriate action,^{w34} and an online interactive monitoring tool has also shown promise.^{w35} Sophisticated inhaler devices may be developed to prompt and record drug delivery.

Fig 5 Asthma UK and other organisations provide useful unbiased management plan templates and other information for patients with asthma

Figure 2 was provided by C Corrigan (King's College School of Medicine).

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Learning outcomes

"Now, what I want is, Facts. Teach these boys and girls nothing but Facts. Facts alone are wanted in life. Plant nothing else, and root out everything else." So said Mr Gradgrind, the headmaster in Charles Dickens's *Hard Times*. And facts are what medical education was once all about. If you went to medical school before 1990 then you learnt facts and were tested on these facts.

But knowledge of facts on their own is not enough to make a good doctor. Indeed, educational research has shown that the methods used to teach may have as big an effect on the retention of information as the content itself.¹ The ensuing process movement in medical education led to innovations such as interprofessional education and problem based learning. How we learn is certainly important, but concentrating too much on this can lead us to forget about the key skills that are needed to practise medicine. And in response to this, the most recent movement in medical education has been the emergence of outcomes based education. Concentrating on outcomes means focusing on what patients and professionals most want—the development of competent and well qualified medical professionals.¹

Concentrating on outcomes could be more important than concentrating on processes or even the content. In the past your aims when teaching may have been to teach about pneumonia or to help students learn about pneumonia or, more specifically, to help students learn how to diagnose and treat pneumonia. But many educationalists would now say that the best way would be to aim that, on completion of the learning, your students will competently diagnose and

treat patients with pneumonia. But we have a way to go before we can prove this. One recent review of the effectiveness of medical education showed that only 18% of studies looked at learners' application of skills and that less than 2% measured changes in patient outcomes as a result of medical education.²

Despite this, outcomes based medical education is on the rise. In Britain we now have a curriculum for junior doctors that is based on outcomes and on the achievement of defined competencies.³ At BMJ Learning we have long been sold on the concept of outcomes. The learning outcomes of one of our most recent modules on cancer care are that, on completing it, you should competently diagnose and treat patients with nausea and vomiting that is related to cancer. We think that these are valid outcomes and that the learning module will help you achieve them, and that the subsequent assessment will enable you to prove that you have achieved them. But we are open to argument and are willing to listen to those who tell us that, to coin a phrase of Yeats, "the best modern way" is not necessarily the best way. Have a look and let us know what you think.

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