



*National Institute for
Clinical Excellence*

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Clinical Excellence***

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**Guidance on
the use of
inhaler systems
(devices) in
children under
the age of 5
years with
chronic asthma**

This document has been circulated to the following:

- Health Authority Chief Executives in England and Wales
- NHS Trust Chief Executives in England and Wales
- PCG Chief Executives
- Local Health Group General Managers
- Medical and Nursing Directors in England and Wales
- Health professionals working with asthma
- GPs in England and Wales
- NHS Director Wales
- Chief Executive of the NHS in England
- NHS Executive Regional Directors
- Special Health Authority Chief Executives
- Community Health Councils in England and Wales
- Patient advocacy groups
- Commission for Health Improvement
- NHS Clinical Governance Support Team
- Chief Medical and Nursing Officers in England and Wales
- Medical Director & Head of NHS Quality – National Assembly for Wales
- Clinical Effectiveness Support Unit - Wales
- Representative bodies for health services, professional organisations and statutory bodies, Royal Colleges

This Guidance is written in the following context:

This guidance represents the view of the Institute's Appraisal Committee, the membership of which is set out in Appendix A, which was arrived at after careful consideration of the available evidence. Health professionals are expected to take it fully into account when exercising their clinical judgement about the use of inhaler systems (devices) in children under the age of 5 years with chronic asthma. This guidance does not, however, override the individual responsibility of health professionals to make appropriate decisions in the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

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**Guidance on the
use of inhaler
systems (devices)
in children under
the age of 5
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chronic asthma**

1. Guidance

- 1.1 For children under the age of 5 years with chronic stable asthma both corticosteroids and bronchodilator therapy should be routinely delivered by pressurised metered dose inhaler (pMDI) and spacer system, with a facemask where necessary.
- 1.2 Where this combination is not clinically effective for the child and depending on the child's condition, nebulised therapy may be considered and in the case of children aged 3 to 5 years, a dry powder inhaler (DPI) may also be considered.
- 1.3 Choice of device to be made within the pMDI and spacer range should be primarily governed by specific individual need and the likelihood of good compliance. Once these factors have been taken into account, choice should be made on the basis of cost minimisation.

This section, Section 1, constitutes the Institute's Guidance on the use of inhaler systems (devices) in children under the age of 5 years with chronic asthma. The remainder of the document is structured in the following way:

2	Clinical Need and Practice	8	Implementation
3	The Technology	9	Clinical Audit Advice
4	Evidence	10	Review of Guidance
5	Implications for the NHS		Appendix A: Appraisal Committee
6	Related Guidance		Appendix B: Sources of Evidence
7	Further Research		Appendix C: Information for Patients.

The full document and a Summary of Evidence are available from our website at www.nice.org.uk or by telephoning 0541 555 455 and quoting the reference number 22197.

Mae'r adran hon (adran 1) hefyd ar gael yn Gymraeg ar ein gwefan neu drwy gysylltu â 0541 555 455, rhif cyfeirnod 22198.

**Technology Appraisal
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- 2.1 Asthma is a common disease that produces symptoms of wheezing and breathlessness. It affects the lower airways and results in narrowing (bronchoconstriction) of the airways with consequent reduction in the flow of gases between the airways and lung alveoli. It can be triggered by a variety of environmental factors such as infection, allergy, airborne chemicals and also exercise. There are a number of patterns of lower airways disease in early childhood that results in two predominant clinical patterns (acute wheezy episodes and recurrent day to day symptoms) that may occur separately or together in the child.
- 2.2 The overall prevalence of asthma in England and Wales is around 8% to 10% although not all cases are currently being treated. In all children under the age of 5 years about 9% of boys and 6% of girls are prescribed inhalers. There is a strong genetic component in the aetiology of this disease. There is also wide geographical variation in prevalence, with asthma being more common in, for example, urban rather than rural communities. It has a wide range of severity, is the cause of considerable morbidity and a rare cause of death.
- 2.3 The primary objective of asthma treatment is to achieve optimal control of the disease by reducing exacerbations, increasing lung function and limiting symptoms in order to maximise the quality of life of the child. This is currently best achieved by delivering both symptom relieving (bronchodilators – including β_2 agonists and anticholinergics) and preventive anti-inflammatory drugs (typically corticosteroids) by inhalation. In the UK, asthma treatment is strongly influenced by the 1997 guidelines of the British Thoracic Society (BTS), which promote step-wise management of increasingly severe asthma. The 1997 BTS guidelines are mainly based on a consensus of expert opinion.
- 2.4 The estimated annual drug cost for asthma to the NHS in England and Wales in all age groups is approximately £115 million. In children under the age of 5 years this cost is about £8 million.

- 3.1 It is important to ensure that an inhaler device delivers the drugs to the airways consistently and in the appropriate quantity. There are a variety of inhaler devices that can be used in the management of asthma: hand held inhalers i.e. pressurised metered dose inhalers (pMDIs) (which can be breath activated or manual) and dry-powder inhalation systems (DPIs) and nebulisers. All the metered dose inhaler systems require co-ordination of activation and inhalation and may be difficult to use, particularly for younger children. For this reason a pMDI should be combined with a spacer device in young children. The purpose of the spacer device is to act as an intermediary chamber into which the pMDI can discharge the drug allowing the child to inhale over several breaths.

3.2 The inhalation devices have different mechanical characteristics which, combined with child and carer factors, leads to variation in both the quantity of drug delivered by the device and the amount actually deposited in the lung. Using the appropriate inhalation device is important to ensure reproducibility and consistency of drug dosing, as well as compliance for which child and carer acceptability and education regarding device usage may also be major factors.

3.3 The 1997 BTS Guidelines recommend the following device choices for children of under 5 years of age:

Age Group	1st Choice Device	2nd Choice Device	3rd Choice Device	Breath-actuated	Dry-powder
0-2 years inclusive	MDI + spacer + face mask	MDI + spacer	Nebuliser (rarely needed)	Avoid	Avoid
3-5 years inclusive	MDI + spacer	MDI + spacer + face mask	Nebuliser (rarely needed)	Not proven	Possible use for β_2 -agonist but not recommended for corticosteroids

3.4 Interpretation of the evidence base for effectiveness of inhaler devices is influenced by a number of potential factors – the drug being delivered by the device, the severity of asthma, whether the condition is acute or chronic and the ability of the child/carer to effectively use the device. Moreover it is not possible to directly extrapolate to children under the age of five years, data collected in older children and adults, as the young child's anatomy and physiology may substantially alter the amount of drug delivered.

4

Evidence

4.1 Delivery of corticosteroids by a hand held device

The evidence base for pressurised metered dose inhalers (pMDIs) plus spacer versus dry-powder inhalation systems (DPI) for the delivery of corticosteroids in children with chronic asthma is relatively small and of poor quality. Two randomised controlled trials were identified, which recruited children of 5 years or under. These trials involved a total of 140 children, although the majority of these recruited children of 5 years or older. One of these trials was inadequately powered and compared a pMDI alone (not recommended by current BTS guidelines) versus DPI. The second and largest trial demonstrated no difference in steroid delivery via a pMDI plus spacer compared to DPI (at half MDI dosage).

4.2 **Delivery of β_2 agonists by a hand held device**

The evidence base for pressurised metered dose inhalers (pMDIs) alone or pMDI plus spacer compared to dry-powder inhalation systems (DPI) in children with chronic asthma is poor. Four randomised controlled trials were identified that recruited children of 5 years or less. These trials involved a total of 278 children, some of which were aged 5 years or more. The remaining three studies demonstrated no difference when comparing β_2 agonist delivery via pMDI plus spacer with β_2 agonist delivery by DPI.

4.3 **Delivery of β_2 agonists or anticholinergics by nebuliser**

The evidence for nebulised bronchodilators compared with bronchodilator delivery via hand held device in children with chronic asthma is also poor. Three randomised controlled trials which recruited children aged 5 years or less, were identified. These trials were small and involved a total of 51 children, although many of the children were aged 5 years or older. No differences were found between nebulisation, pMDIs or dry powder devices. These trials are likely to be of insufficient size to detect small differences between devices.

4.4 **Cost Effectiveness**

There is currently a wide range in the cost of drug/inhaler combinations. No cost effectiveness studies were identified that make direct comparison between asthma devices in children under the age of 5 years with chronic asthma.

4.5 The documentation and opinion available to the Appraisal Committee is set out in Appendix B.

5

Implications for the NHS

5.1 Where the 1997 BTS guidelines are currently being applied in practice, the guidance is unlikely to result in substantial change in NHS costs. The impact of referral patterns is difficult to predict. It is likely however to strengthen and improve the quality of primary care based asthma therapy, thereby reducing the need for admission or outpatient referral.

6

Further Research

6.1 At present there is insufficient evidence regarding the most clinically and cost effective spacer (e.g. small or large volume). This is reflected in the current lack of standardisation and variations in the usage of these devices. Further research in this area should be carried out in relation to optimising the reproducibility, consistency and acceptability of these delivery systems as well as their overall clinical and cost effectiveness.

6.2 Well conducted community based trials in the management of asthma in young children and studies to investigate factors determining compliance (including health education and the acceptability of devices) in this group of children would enhance the future evidence base.

7

Implementation

- 7.1 Clinicians should review their current clinical practice for the management of chronic asthma in children under the age of 5 years against the guidance set out in section 1.
- 7.2 Relevant clinical guidelines and protocols should be reviewed in light of this guidance and revised if necessary.
- 7.3 The appropriate selection of inhaler devices as described in this guidance, is only one aspect for the provision of a comprehensive holistic approach to all aspects of asthma management. In particular, parents/carers need education, support and guidance, on how to manage their child's condition. General practitioners, the practice nurse, the specialist asthma nurse, the health visitor and school nurse and other community health carers have an essential role in the provision of this service and advice on general management may result in additional improvements in clinical and cost effectiveness.
- 7.4 The Montreal Protocol has mandated that CFC propellant should be phased out, and in the UK, the transition to CFC-free propellants is currently under way. The majority of evidence reviewed (see paragraph 4) on the use of devices is based on the use of corticosteroids and bronchodilators with CFC propellants. CFC-free propellants may interact with spacers differently to CFC-propellants, and can therefore affect the dose of drug delivered by the spacer. In addition, not all spacers are compatible with all pressurised metered dose inhalers (pMDIs). The choice of spacer for the chosen pMDI should therefore be guided by the information in the Summary of the Product Characteristics.
- 7.5 The dosage of drug delivered may vary considerably according to the static charge on spacer devices. It is therefore advised that spacers be washed in a household detergent and allowed to air dry. If there are concerns about the possibility of contact dermatitis using this method, the mouthpiece of facemask should be rinsed in water and dried.

8

Clinical Audit Advice

- 8.1 To enable clinicians to audit their own compliance with this guidance it is recommended that, if not already in place, management plans are recorded for each child with chronic asthma. These plans should record the type of devices prescribed.
- 8.2 This information should be incorporated into local clinical audit data recording systems and consideration given (if not already in place) to the establishment of appropriate categories in electronic record systems.

9

Review of Guidance

8.3 Prospective clinical audit programmes should record the proportion of treatments adhering to the guidance. Such programmes are likely to be more effective in improving patient care when they form part of the organisation's formal clinical governance arrangements and where they are linked to specific post-graduate activities.

9.1 This advice will be reviewed in the light of new evidence in August 2003.

Andrew Dillon
Chief Executive
August 2000

APPENDIX A

Appraisal Committee Members

Professor R. L. Akehurst
Dean, School of Health Related
Research
Sheffield University

**Professor David Barnett
(Chairman)**
Professor of Clinical Pharmacology
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Professor Philip Routledge
Professor of Clinical Pharmacology
University of Wales

Professor Andrew Stevens
Professor of Public Health
University of Birmingham

APPENDIX B

Sources of Evidence

- i) The following documentation and opinion was made available to the Committee:
 - a) Assessment Report
The effectiveness of inhaler devices for young children with asthma; Prepared by Payne N & Beard S, Trent Institute for Health Services Research, School of Health & Related Research, University of Sheffield; Wright, Brocklebank, D & Ram F, Bradford Hospitals NHS Trust; Taylor RS, National Institute for Clinical Excellence. March 2000.
 - b) Manufacturer/Sponsor submissions:
 - i. AstraZeneca
 - ii. Boehringer Ingelheim Ltd.
 - iii. Aventis Pharma (formerly Rhône-Poulenc Rorer)
 - iv. Boehringer Ingelheim Ltd.
 - v. Glaxo Wellcome
 - vi. 3M Health Care Ltd.
 - vii. Norton Healthcare
 - viii. Yamanouchi Pharma Ltd.
 - c) Professional/specialist group, patient/carer group and trade association submissions:
 - i. Association of British Health-Care Industries
 - ii. British Medical Association
 - iii. British Thoracic Society
 - iv. National Asthma Campaign
 - v. Royal College of Nursing
 - vi. Royal College of Paediatrics & Child Health
 - vii. Royal College of Physicians
 - ii) The following experts were invited to make submissions to the Committee:
 - a) Dr Andrew Bush, Reader in Paediatric Respiriology & Honorary Consultant Paediatric Chest Physician, Royal Brompton Hospital, London.
 - b) Dr C O'Callaghan, Senior Lecturer & Consultant Paediatrician, University of Leicester & Leicester Royal Infirmary Children's Hospital.

APPENDIX C

Guidance on inhalers for childhood asthma – patient information

The patient information in this appendix has been designed to support the production of your own information leaflets; you can download it from our web site (www.nice.org.uk) where it is available in English and Welsh. A printed version of this text is available in English/Welsh or English alone. If you would like copies of the printed leaflet please contact 0541 555 455, and quote the reference number 22200 for the English/Welsh version and 22199 for the English only version.

What is NICE Guidance?

The National Institute for Clinical Excellence (NICE) is part of the NHS. It produces guidance for both the NHS and patients on medicines, medical equipment and clinical procedures and where they should be used.

When the Institute evaluates these things it is called an appraisal. Each appraisal takes about 12 months to complete and involves the manufacturers of the drug or device, professional organisations and the groups who represent patients.

NICE was asked to look at the available evidence on inhaler devices and provide guidance that would help the NHS decide which should be used for childhood asthma for children under five.

What is asthma?

Asthma is a common condition that affects the airways – the small tubes that carry air in and out of the lungs. It causes a narrowing of these airways and this makes breathing more difficult. Patients may have wheezy episodes and quickly become out of breath. Asthma can be triggered by a number of factors that include infection, allergy or exercise. It is more widespread in urban than rural communities.

In children under the age of 5 years around 9 out of 100 boys and 6 out of 100 of girls are currently being prescribed inhalers.

How do inhaler devices help asthma?

Most asthma medication is delivered using an inhaler device. This ensures that very small amounts of medication are delivered directly into the lungs. Asthma treatment aims to prevent an increase in the severity of the disease, increase lung function and reduce the number of attacks. There are two main types of asthma medication: relievers (usually blue) that provide relief from asthma and preventers (brown, white, red or orange) which work over a period of time to help calm the inflammation of the airways making them less likely to react.

What are inhalers?

Inhalers are small devices which ensure that very small amounts of medication are delivered directly into the lungs. It is important to ensure that an inhaler device delivers the drugs to the airways consistently and in the right quantity. There are a variety of inhaler devices that can be used in the management of asthma including:

- Pressurised Metered Dose Inhalers (pMDIs)
- Dry-Powder Inhalation systems (DPIs)
- nebulisers.

All the Metered Dose Inhalers require the patient to be able to activate the device and breath in at the same time. For this reason they may be difficult for younger children to use for this reason they should be combined with a spacer device in young children. The purpose of the spacer device is to act as an intermediary chamber into which the Pressurised Metered Dose Inhaler (pMDI) can deposit the drug allowing the child to inhale the drug over several breaths.

What has NICE recommended about the use of inhaler devices?

NICE has recommended that for children under the age of 5 years who have chronic stable asthma:

- both corticosteroids and bronchodilator therapy should routinely delivered by Pressurised Metered Dose Inhaler (pMDI) and spacer system, with a facemask where necessary.
- where this combination is not clinically effective for the child, and depending on the child's condition, nebulised therapy may be considered and in the case of children aged 3 to 5 years, a dry powder inhaler (DPI) may also be considered.
- the choice of which pMDI device and spacer to use should be determined by the specific needs of the child and how well it works for them. Once these factors have been taken into account the choice should be made on the basis of reducing costs.

Clinicians should review their current clinical practice for the management of chronic asthma in children under the age of 5 years against this guidance.

The appropriate selection of inhaler devices as described is only one aspect for the provision of a comprehensive approach to all aspects of managing asthma. In particular, parents/carers need education, support and guidance, on how to manage their child's condition. General practitioners, the practice nurse, the specialist asthma nurse, the health visitor and school nurse and other community health carers have an essential role in the provision of this service and advice on general management may result in additional improvements in clinical and cost effectiveness.

What should I do?

If your child or a child you care for has asthma, you should discuss this guidance with a health professional at your next appointment.

Will NICE review its guidance?

Yes. This guidance will be reviewed in August 2003.

Further Information

Further information on NICE, and the full guidance issued to the NHS is available on the NICE web site (www.nice.org.uk). It can also be requested from 0541 555 455, quoting reference number 22197.