

VERSION 2.0

# MANAGEMENT

*Written asthma action plans*

*Adherence*

*Inhaler devices and technique*

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## ABBREVIATIONS

|                        |  |                        |   |
|------------------------|--|------------------------|---|
| <b>CFC</b>             | chlorofluorocarbon   | <b>LTRA</b>            | leukotriene receptor antagonist                                   |
| <b>COPD</b>            | chronic obstructive pulmonary disease                      | <b>MBS</b>             | Medical Benefits Scheme   |
| <b>COX</b>             | cyclo-oxygenase  | <b>NHMRC</b>           | National Health and Medical Research Council                      |
| <b>DXA</b>             | dual-energy X-ray absorptiometry                           | <b>NIPPV</b>           | non-invasive positive pressure ventilation                        |
| <b>ED</b>              | emergency department                                       | <b>NSAIDs</b>          | nonsteroidal anti-inflammatory drugs                              |
| <b>EIB</b>             | exercise-induced bronchoconstriction                       | <b>OCS</b>             | oral corticosteroids  |
| <b>FEV<sub>1</sub></b> | forced expiratory volume over one second                   | <b>OSA</b>             | obstructive sleep apnoea  |
| <b>FEV<sub>6</sub></b> | forced expiratory volume over six seconds                  | <b>PaCO</b>            | carbon dioxide partial pressure on blood gas analysis             |
| <b>FSANZ</b>           | Food Standards Australia and New Zealand                   | <b>PaO</b>             | oxygen partial pressure on blood gas analysis                     |
| <b>FVC</b>             | forced vital capacity                                      | <b>PBS</b>             | Pharmaceutical Benefits Scheme                                    |
| <b>GORD</b>            | gastro-oesophageal reflux disease                          | <b>PEF</b>             | peak expiratory flow  |
| <b>HFA</b>             | formulated with hydrofluoroalkane propellant               | <b>pMDI</b>            | pressurised metered-dose inhaler or 'puffer'                      |
| <b>ICS</b>             | inhaled corticosteroid                                     | <b>PPE</b>             | personal protective equipment                                     |
| <b>ICU</b>             | intensive care unit  | <b>SABA</b>            | short-acting beta <sub>2</sub> -adrenergic receptor agonist       |
| <b>IgE</b>             | Immunoglobulin E   | <b>SAMA</b>            | short-acting muscarinic antagonist                                |
| <b>IL</b>              | interleukin  | <b>SaO<sub>2</sub></b> | oxygen saturation   |
| <b>IU</b>              | international units  | <b>SpO<sub>2</sub></b> | peripheral capillary oxygen saturation measured by pulse oximetry |
| <b>IV</b>              | intravenous  | <b>TGA</b>             | Therapeutic Goods Administration                                  |
| <b>LABA</b>            | long-acting beta <sub>2</sub> -adrenergic receptor agonist |                        |   |
| <b>LAMA</b>            | long-acting muscarinic antagonist                          |                        |   |

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## Written asthma action plans

### Overview

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Every adult and child with asthma should have their own written asthma action plan that provides clear instructions on how to adjust medication in response to asthma symptoms, and when and how to get medical care, including during an emergency.

Written asthma action plans should be individualised for the patient (e.g. clearly naming the medicines the person uses, using words they will understand, identifying individual signs of flare-ups). They should be reviewed regularly.

- ▶ See: [Providing self-management support for adults](#)
- See: [Providing asthma management education for parents and children](#)
- See: [Supporting adolescents and young adults to self-manage their asthma](#)

### In this section

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#### *Action plans: adults*

Preparing written asthma action plans for adults and adolescents

<http://www.asthmahandbook.org.au/management/action-plans/waap-adults>

#### *Action plans: children*

Preparing written asthma action plans for children


<http://www.asthmahandbook.org.au/management/action-plans/waap-children>

# Preparing written asthma action plans for adults and adolescents

## Recommendations

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For every person with asthma, develop an individualised written asthma action plan that is appropriate for their treatment regimen, asthma severity, culture, language, literacy level, and ability to self-manage.

 *How this recommendation was developed*

Consensus

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


A written asthma action plan should include all of the following:

- the person's usual asthma and allergy medicines
- clear instructions on how to change medication (including when and how to start a course of oral corticosteroids)
- when and how to get medical care, including during an emergency
- name of the person preparing the plan
- the date.

Note: A range of templates is available from National Asthma Council Australia's [Asthma Action Plan Library](#).

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


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

 *How this recommendation was developed*

Consensus

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


Ensure the person has a prescription for any medicines they may need to follow their action plan (e.g. prednisolone). Explain which medicines they should have available at all times, or when to fill prescriptions to have medicines available (e.g. before travel).

 *How this recommendation was developed*

Consensus

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

Review the written asthma action plan every year, and whenever there is a significant change in treatment or asthma status.

 *How this recommendation was developed*

Consensus

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

When reviewing a written asthma action plan, consider the following:


- Does the person know where their written asthma action plan is?
- Have they used it? If so, any problems?
- Are listed medicines and instruction for actions current and appropriate?

- Are contact details for medical care and acute care up to date?

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.


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 *How this recommendation was developed*

Consensus

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


For people who are unable to read a written asthma action plan easily due to poor eyesight or when written English is inappropriate, consider a pictorial action plan.

 *How this recommendation was developed*

Consensus

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

For every person with a history of anaphylaxis (or risk factors), also provide a written anaphylaxis plan.

 *How this recommendation was developed*

Consensus

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

## More information

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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.<sup>1</sup> Written asthma action plans are effective if based on symptoms<sup>2</sup> or personal best peak expiratory flow (not on percentage predicted).<sup>1</sup>

### **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,
















Consider whether any common barriers to correct use of medicines apply:


- misunderstanding purpose of medicines
- concerns about side effects
- taking wrong dose
- skipping doses to save on treatment costs
- incorrect inhaler technique
- poor perception of airflow limitation
- social pressure from peer group, employer, colleagues or family (e.g. expectation that should have grown out of asthma)
- beliefs about health that conflict with or undermine confidence in conventional asthma medicines.

 *How this recommendation was developed*

**Consensus**

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

Before considering any increase in dose or addition to treatment regimen (step up), check the patient's adherence to the medication most recently prescribed.

 *How this recommendation was developed*

**Consensus**

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

## More information

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### *Adherence to preventer treatment: adults and adolescents*

Most patients do not take their preventer medication as often as prescribed, particularly when symptoms improve, or are mild or infrequent. Whenever asthma control is poor despite apparently adequate treatment, poor adherence, as well as poor inhaler technique, are probable reasons to consider.

Poor adherence may be intentional and/or unintentional. Intentional poor adherence may be due to the person's belief that the medicine is not necessary, or to perceived or actual adverse effects. Unintentional poor adherence may be due to forgetting or cost barriers.

Common barriers to the correct use of preventers include:

- being unable to afford the cost of medicines or consultations to adjust the regimen
- concerns about side effects
- interference of the regimen with the person's lifestyle
- forgetting to take medicines
- lack of understanding of the reason for taking the medicines
- inability to use the inhaler device correctly due to physical or cognitive factors
- health beliefs that are in conflict with the belief that the prescribed medicines are effective, necessary or safe (e.g. a belief that the prescribed preventer dose is 'too strong' or only for flare-ups, a belief that asthma can be overcome by psychological effort, a belief that complementary and alternative therapies are more effective or appropriate than prescribed medicines, mistrust of the health professional).

Adherence to preventers is significantly improved when patients are given the opportunity to negotiate the treatment regimen based on their goals and preferences.<sup>1</sup>

Assessment of adherence requires an open, non-judgemental approach.

Accredited pharmacists who undertake Home Medicines Reviews can assess adherence while conducting a review.

### **Table. Suggested questions to ask adults and older adolescents when assessing adherence to treatment**

1. *Many people don't take their medication as prescribed. In the last four weeks:*

- how many days a week would you have taken your preventer medication? None at all? One? Two? (etc).

- how many times a day would you take it? Morning only? Evening only? Morning and evening? (or other)
- each time, how many puffs would you take? One? Two? (etc).

2. Do you find it easier to remember your medication in the morning, or the evening?

Source: Foster JM, Smith L, Bosnic-Anticevich SZ et al. Identifying patient-specific beliefs and behaviours for conversations about adherence in asthma. *Intern Med J* 2012; 42: e136-e44. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21627747>

Asset ID: 38

► Go to: Medicare's [Home Medicines Review \(HMR\)](#)

## Home Medicines Review and MedsCheck

### Home Medicines Review

A Home Medicines Review involves the patient, their GP, an accredited pharmacist and a community pharmacy. Referral (Medicare Item 900) may be either direct to an accredited pharmacist, or to a community pharmacy that uses the services of an accredited pharmacist.

The accredited pharmacist visits the patient at their home, reviews their medicine regimen and provides a report to the person's GP and usual community pharmacy. The GP and patient then agree on a medication management plan.

The aims of Home Medicines Review include detecting and overcoming any problems with the person's medicines regimen, and improving the patient's knowledge and understanding of their medicines.

Patients could be eligible for a Home Medicines Review if they (any of):

- take more than 12 doses of medicine per day
- have difficulty managing their own medicines because of literacy or language difficulties, or impaired eyesight
- visit multiple specialists
- have been discharged from hospital in the previous four weeks
- have changed their medicines regimen during the past 3 months
- have experienced a change in their medical condition or abilities
- are not showing improvement in their condition despite treatment
- have problems managing their delivery device
- have problems taking medicines because of confusion, limited dexterity or poor eyesight.

► Go to: Medicare's [Home Medicines Review \(HMR\)](#)

### MedsCheck

MedsCheck involves review of a patient's medicines by a registered pharmacist within the pharmacy.

Patients are eligible if they take multiple medicines, and they do not need a referral from a GP.

The pharmacist makes a list of all the person's medicines and medication or monitoring devices, and discusses them with the patient to identify any problems. If necessary, the pharmacist refers any issues back to the person's GP or other health professional.

► Go to: Australian Department of Health's [Medication Use Review \(MedsCheck\)](#)

Last reviewed version 2.0

## Psychosocial factors affecting asthma self-management

Psychosocial factors can affect asthma symptoms and outcomes in children and adults. These can include biological, individual, family and community-level factors, which can have synergistic effects in an individual with asthma.<sup>2</sup> Mechanisms may include effects of stress on the immune system<sup>2</sup> and effects of life circumstances on patients' and families' ability to manage asthma.

### Relationships between psychosocial and cultural factors

Important influences on asthma outcomes include the person's asthma knowledge and beliefs, confidence in ability to self-manage, perceived barriers to healthcare, socioeconomic status, and healthcare system navigation skills, and by the quality of interaction and communication between patient and healthcare provider.<sup>3</sup> There is a complex interrelationship between:<sup>3</sup>

- patient factors (e.g. health literacy, health beliefs, ethnicity, educational level, social support, cultural beliefs, comorbidities, mental health)
- healthcare provider factors (e.g. communication skills, teaching abilities, available time, educational resources and skills in working with people from different backgrounds)

- healthcare system factors (e.g. the complexity of the system, the healthcare delivery model, the degree to which the system is oriented towards chronic disease management or acute care, and the degree to which the system is sensitive to sociocultural needs).

## Health literacy

'Health literacy' refers to the individual's capacity to obtain, process, and understand basic health information and services they need to make appropriate health decisions.<sup>4</sup> A person's level of health literacy is influenced by various factors including skills in reading, writing, numeracy, speaking, listening, cultural and conceptual knowledge.<sup>3</sup>

Inadequate health literacy is recognised as a risk factor for poorer health outcomes and less effective use of health care services.<sup>3</sup> Poor health literacy has been associated with poor asthma control,<sup>5</sup> poor knowledge of medications,<sup>6</sup> and incorrect inhaler technique.<sup>6</sup> Aspects of health literacy that have been associated with poorer asthma outcomes in adults include reading skills, listening skills, numeracy skills, and combinations of these.<sup>3</sup> Studies assessing the association between parents' health literacy and children's asthma have reported inconsistent findings.<sup>3</sup> Overall, there is not enough evidence to prove that low health literacy causes poor asthma control or inadequate self-management.<sup>3</sup>

Australian research suggests that there are probably many Australians with limited health literacy.<sup>7</sup> It may be possible to identify some groups of patients more likely to have inadequate health literacy, such as people living in regions with low socioeconomic status, and those with low English literacy (e.g. people with limited education, members of some ethnic minorities, immigrants, and the elderly).<sup>3</sup> However, even well-educated patients might have trouble with basic health literacy skills.<sup>3</sup>

Attempting to assess every patient's health literacy is impractical and may be embarrassing for the person and time-consuming for the health professional.<sup>3</sup> Instead, it may be more effective for health professionals simply to assume that all patients have limited health literacy.<sup>3</sup> Accordingly, all self-management skills need to be explained carefully, simply and repeatedly, and all written material should be clear and easy to read. Special consideration is needed for patients from culturally and linguistically diverse communities, including Aboriginal and Torres Strait Islander people.

## Psychosocial support and improving health literacy

Psychosocial interventions that include asthma education may improve health-related quality of life for children and adolescents with asthma and their families.<sup>8</sup> However, simply providing education might not improve a person's health literacy, since it also depends on other factors like socioeconomic status, social support, and is influenced by the provider and the healthcare system.<sup>3</sup>

Asthma Australia provides personal support and information for people with asthma and parents of children with asthma through the Asthma Australia Information line by telephone on 1800 Asthma (1800 278 462) or [online](#).

► Go to: [Asthma Australia](#)

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# Maximising patients' adherence to asthma treatment

## Recommendations

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Ensure every patient has a written asthma action plan appropriate to their age and self-management capability.

 *How this recommendation was developed*

**Consensus**

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


Check that patients and carers understand the dose regimen and the written asthma action plan.

 *How this recommendation was developed*

**Consensus**

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


If adherence to preventer medicines is inadequate, explore barriers and motivating factors.

 *How this recommendation was developed*

**Consensus**

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


Explain to young people that asthma medicines do not have any effects on sexual activity or fertility in the short-term or long-term.

 *How this recommendation was developed*

**Consensus**

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

Advise pregnant women that good asthma control during pregnancy is a high priority, to protect the foetus as well as the mother. Explain that asthma medicines are used in pregnancy when the risks of poor asthma control outweigh the risks associated with medicines. If preventer therapy (e.g. low-dose inhaled corticosteroid) has been prescribed or is indicated, advise the woman to keep taking her preventer throughout pregnancy.

 *How this recommendation was developed*


**Consensus**

Based on clinical experience and expert opinion (informed by evidence, where available), with particular reference to the following source(s):

- Ali and Ulrik, 2013<sup>1</sup>
- Clifton *et al.* 2009<sup>2</sup>
- Murphy and Gibson, 2011<sup>3</sup>
- Murphy *et al.* 2005<sup>4</sup>
- Murphy *et al.* 2006<sup>5</sup>
- Murphy *et al.* 2011<sup>6</sup>
- Namazy *et al.* 2012<sup>7</sup>

- Silverman *et al.* 2005<sup>8</sup>

For patients who have difficulty using their asthma medicines correctly, consider referral to an asthma educator, MedsCheck by a community pharmacist, or Home Medicines Review by an accredited pharmacist (if eligible) – particularly for those who need to take multiple medicines (e.g. for concurrent conditions).

 *How this recommendation was developed*

#### Consensus

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

## More information

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### *Adherence to preventer treatment: adults and adolescents*

Most patients do not take their preventer medication as often as prescribed, particularly when symptoms improve, or are mild or infrequent. Whenever asthma control is poor despite apparently adequate treatment, poor adherence, as well as poor inhaler technique, are probable reasons to consider.

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Common barriers to the correct use of preventers include:

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- interference of the regimen with the person's lifestyle
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- lack of understanding of the reason for taking the medicines
- inability to use the inhaler device correctly due to physical or cognitive factors
- health beliefs that are in conflict with the belief that the prescribed medicines are effective, necessary or safe (e.g. a belief that the prescribed preventer dose is 'too strong' or only for flare-ups, a belief that asthma can be overcome by psychological effort, a belief that complementary and alternative therapies are more effective or appropriate than prescribed medicines, mistrust of the health professional).

Adherence to preventers is significantly improved when patients are given the opportunity to negotiate the treatment regimen based on their goals and preferences.<sup>9</sup>

Assessment of adherence requires an open, non-judgemental approach.

Accredited pharmacists who undertake Home Medicines Reviews can assess adherence while conducting a review.

### **Table. Suggested questions to ask adults and older adolescents when assessing adherence to treatment**

1. *Many people don't take their medication as prescribed. In the last four weeks:*
  - how many days a week would you have taken your preventer medication? None at all? One? Two? (etc).
  - how many times a day would you take it? Morning only? Evening only? Morning and evening? (or other)
  - each time, how many puffs would you take? One? Two? (etc).
2. *Do you find it easier to remember your medication in the morning, or the evening?*

Source: Foster JM, Smith L, Bosnic-Anticevich SZ *et al.* Identifying patient-specific beliefs and behaviours for conversations about adherence in asthma. *Intern Med J* 2012; 42: e136-e44. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21627747>

Asset ID: 38

► Go to: Medicare's [Home Medicines Review \(HMR\)](#)



## Home Medicines Review and MedsCheck

### Home Medicines Review

A Home Medicines Review involves the patient, their GP, an accredited pharmacist and a community pharmacy. Referral (Medicare Item 900) may be either direct to an accredited pharmacist, or to a community pharmacy that uses the services of an accredited pharmacist.

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Patients could be eligible for a Home Medicines Review if they (any of):

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- have been discharged from hospital in the previous four weeks
- have changed their medicines regimen during the past 3 months
- have experienced a change in their medical condition or abilities
- are not showing improvement in their condition despite treatment
- have problems managing their delivery device
- have problems taking medicines because of confusion, limited dexterity or poor eyesight.

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### MedsCheck

MedsCheck involves review of a patient's medicines by a registered pharmacist within the pharmacy.

Patients are eligible if they take multiple medicines, and they do not need a referral from a GP.

The pharmacist makes a list of all the person's medicines and medication or monitoring devices, and discusses them with the patient to identify any problems. If necessary, the pharmacist refers any issues back to the person's GP or other health professional.

► Go to: Australian Department of Health's [Medication Use Review \(MedsCheck\)](#)

*Last reviewed version 2.0*

## Psychosocial factors affecting asthma self-management

Psychosocial factors can affect asthma symptoms and outcomes in children and adults. These can include biological, individual, family and community-level factors, which can have synergistic effects in an individual with asthma.<sup>10</sup> Mechanisms may include effects of stress on the immune system<sup>10</sup> and effects of life circumstances on patients' and families' ability to manage asthma.

### Relationships between psychosocial and cultural factors

Important influences on asthma outcomes include the person's asthma knowledge and beliefs, confidence in ability to self-manage, perceived barriers to healthcare, socioeconomic status, and healthcare system navigation skills, and by the quality of interaction and communication between patient and healthcare provider.<sup>11</sup> There is a complex interrelationship between:<sup>11</sup>

- patient factors (e.g. health literacy, health beliefs, ethnicity, educational level, social support, cultural beliefs, comorbidities, mental health)
- healthcare provider factors (e.g. communication skills, teaching abilities, available time, educational resources and skills in working with people from different backgrounds)
- healthcare system factors (e.g. the complexity of the system, the healthcare delivery model, the degree to which the system is oriented towards chronic disease management or acute care, and the degree to which the system is sensitive to sociocultural needs).

### Health literacy

'Health literacy' refers to the individual's capacity to obtain, process, and understand basic health information and services they need to make appropriate health decisions.<sup>12</sup> A person's level of health literacy is influenced by various factors including skills in reading, writing, numeracy, speaking, listening, cultural and conceptual knowledge.<sup>11</sup>

Inadequate health literacy is recognised as a risk factor for poorer health outcomes and less effective use of health care services.<sup>11</sup> Poor health literacy has been associated with poor asthma control,<sup>13</sup> poor knowledge of medications,<sup>14</sup> and incorrect inhaler technique.<sup>14</sup> Aspects of health literacy that have been associated with poorer asthma outcomes in adults include reading skills, listening skills, numeracy skills, and combinations of these.<sup>11</sup> Studies assessing the association between parents' health literacy and children's asthma have reported inconsistent findings.<sup>11</sup> Overall, there is not enough evidence to prove that low health literacy causes poor

asthma control or inadequate self-management.<sup>11</sup>

Australian research suggests that there are probably many Australians with limited health literacy.<sup>15</sup> It may be possible to identify some groups of patients more likely to have inadequate health literacy, such as people living in regions with low socioeconomic status, and those with low English literacy (e.g. people with limited education, members of some ethnic minorities, immigrants, and the elderly).<sup>11</sup> However, even well-educated patients might have trouble with basic health literacy skills.<sup>11</sup>

Attempting to assess every patient's health literacy is impractical and may be embarrassing for the person and time-consuming for the health professional.<sup>11</sup> Instead, it may be more effective for health professionals simply to assume that all patients have limited health literacy.<sup>11</sup> Accordingly, all self-management skills need to be explained carefully, simply and repeatedly, and all written material should be clear and easy to read. Special consideration is needed for patients from culturally and linguistically diverse communities, including Aboriginal and Torres Strait Islander people.

### Psychosocial support and improving health literacy

Psychosocial interventions that include asthma education may improve health-related quality of life for children and adolescents with asthma and their families.<sup>16</sup> However, simply providing education might not improve a person's health literacy, since it also depends on other factors like socioeconomic status, social support, and is influenced by the provider and the healthcare system.<sup>11</sup>

Asthma Australia provides personal support and information for people with asthma and parents of children with asthma through the Asthma Australia Information line by telephone on 1800 Asthma (1800 278 462) or [online](#).

► Go to: [Asthma Australia](#)

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## Inhaler devices and technique

### Overview

The main types of inhaler devices for asthma and COPD medicines are:

- manually-actuated pressurised metered-dose inhalers (conventional puffer)
- breath-actuated pressurised metered-dose inhalers
- dry powder inhalers (multi-dose and capsule types)
- mist inhalers.

The correct inhaler technique depends on the device. Poor inhaler technique is extremely common and is associated with worse outcomes in asthma and COPD, including poor asthma symptom control and overuse of relievers and preventers.

Regardless of the type of inhaler device prescribed, all patients need training in correct inhaler technique, including a physical demonstration. As inhaler technique worsens over time, all patients need regular checking to ensure they are using their inhalers correctly.

*Table. Types of inhaler devices for delivering asthma and COPD medicines*

Please view and print this figure separately: <http://www.astmahandbook.org.au/table/show/75>

*Table. Considerations for choice of inhaler device type when prescribing inhaled medicines*

| Clinical situation  | Consideration  |
|---|--|
| <i>Acute asthma (all patients)</i>  | Recommend use of spacer when using reliever via pMDI for acute asthma  |
| <i>Any patient using a pMDI for an inhaled corticosteroid</i>   | Recommend use of a spacer every time (except for breath-actuated pMDIs)  |
| <i>Infants and small children</i>   | Use a spacer with a facemask   |
| <i>Poor manual dexterity (e.g. weak hands or arthritis)</i>   | Consider either of: <ul style="list-style-type: none"> <li>• a <i>Haleraid</i> device with relevant pMDIs (available for salbutamol, fluticasone, fluticasone/salmeterol)</li> <li>• a breath-actuated inhaler</li> </ul>  |
| <i>Difficulty connecting spacer to pMDI (e.g. elderly patient with weakness or poor coordination)</i>                         | Leave spacer connected: pharmacist can attach spacer to inhaler each time canister is replaced, and leave attached until medicine is used up. (If patient uses more than one pMDI, provide a separate spacer for each device.<br><br>Consider a breath-actuated inhaler. |
| <i>Inability to form a good seal around the mouthpiece of the inhaler or spacer (e.g. person with cognitive impairment or</i> | Consider a spacer plus age-appropriate facemask  |

| Clinical situation                            | Consideration   |
|---|---|
| <i>facial weakness)</i>                       |   |
| <i>Difficulty speaking or reading English</i> | <p>Give a physical demonstration</p> <p><b>Use videos</b></p> <p>Use an interpreter or provide written instructions in the person's first language</p>  |
| <i>Using multiple inhalers</i>                | <p>Choose the same type for each medicine, if possible, to avoid confusion</p> <p>If not possible, train person in the correct inhaler technique for each of their devices, emphasising any key differences (e.g. speed of inhalation, shake pMDIs but not dry-powder inhalers)</p> |

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- ▶ Go to: National Asthma Council Australia's [Inhaler technique in adults with asthma or COPD](#) information paper
- Go to: National Asthma Council Australia's [How-to videos](#) demonstrating correct inhaler technique in adults for each inhaler device type

## In this section

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### *Device choice*

Choosing an inhaler device to suit the individual

<http://www.asthmahandbook.org.au/management/devices/device-choice>

### *Inhaler technique*

Training patients in inhaler technique

<http://www.asthmahandbook.org.au/management/devices/inhaler-technique>

### *Using inhalers*

Considerations when using inhaled reliever or preventer medicines

<http://www.asthmahandbook.org.au/management/devices/using-inhalers>

### *Spacers*

Use and care of spacers

<http://www.asthmahandbook.org.au/management/devices/spacers>

## Table. Types of inhaler devices for delivering asthma and COPD medicines

- Advise patients/carers that inhalers should be stored below 30°C and should not be left in cars.

| Type  | Common medicines   | Pharmacological class | Function  |
|---|--|-----------------------|-----------|
| <b>Manually actuated pressurised metered-dose inhaler (puffer)</b><br><br>e.g. <i>Rapihaler</i> , various generic names such as inhaler, CFC-free inhaler and metered aerosol | <i>Airomir Inhaler</i> (salbutamol)  | SABA                  | Reliever  |
|   | <i>Asmol CFC-Free Inhaler</i> (salbutamol)   | SABA                  |           |
|   | <i>Ventolin CFC-Free Inhaler</i> (salbutamol)  | SABA                  |           |
|   | <i>Symbicort Rapihaler</i> (budesonide plus formoterol)*                                 | ICS + LABA            |           |
|   | <i>Alvesco Metered-dose Inhaler</i> (ciclesonide)  | ICS                   | Preventer |
|   | <i>Flixotide Junior/Flixotide Inhaler</i> (fluticasone propionate)                       | ICS                   |           |
|   | <i>Fluair Inhaler</i> (fluticasone propionate)   | ICS                   |           |
|   | <i>Fluticasone Cipla Metered-dose Inhaler</i> (fluticasone propionate)                   | ICS                   |           |
|   | <i>Qvar</i> (beclometasone)  | ICS                   |           |
|   | <i>Fluticasone and Salmeterol Cipla Inhaler</i> (fluticasone propionate plus salmeterol) | ICS + LABA            |           |
|   | <i>Flutiform Metered-dose Inhaler</i> (fluticasone propionate plus formoterol)           | ICS + LABA            |           |
|   | <i>SalplusF Metered-dose Inhaler</i> (fluticasone propionate plus salmeterol)            | ICS + LABA            |           |
|   | <i>Seretide MDI</i> (fluticasone propionate plus salmeterol)                             | ICS + LABA            |           |
|   | <i>Symbicort Rapihaler</i> (budesonide plus formoterol)                                  | ICS + LABA            |           |
|   | <i>Intal CFC-Free Inhaler/IntalForte CFC-Free Inhaler</i> (sodium cromoglycate)          | Cromone               |           |
| <i>Tilade CFC-Free</i> (nedocromil sodium)  | Cromone  |                       |           |

| Type  | Common medicines   | Pharmacological class                    | Function             |   |
|---|--|--|----------------------|---|
|   | <i>Atrovent Metered Aerosol</i> (ipratropium)                          | SAMA                                     | Other bronchodilator |   |
| <b>Breath-actuated pressurised metered-dose inhaler</b><br>e.g. <i>Autohaler</i>                        | <i>Airomir Autohaler</i> (salbutamol)                                  | SABA                                     | Reliever             |   |
|   | <i>Qvar Autohaler</i> (beclometasone)                                  | ICS                                      | Preventer            |   |
| <b>Dry powder inhaler (multi-dose)</b><br>e.g. <i>Accuhaler, Ellipta, Genuair, Spiromax, Turbuhaler</i> | <i>Bricanyl Turbuhaler</i> (terbutaline sulfate)                       | SABA                                     | Reliever             |   |
|   | <i>Symbicort Turbuhaler</i> (budesonide plus formoterol)*              | ICS + LABA                               |                      |   |
|   | <i>DuoResp Spiromax</i> (budesonide plus formoterol)*                  | ICS + LABA                               |                      |   |
|   | <i>Arnuity Ellipta</i> (fluticasone furoate)†                          | ICS                                      | Preventer            |   |
|   | <i>Flixotide Junior / Flixotide Accuhaler</i> (fluticasone propionate) | ICS                                      |                      |   |
|   | <i>Pulmicort Turbuhaler</i> (budesonide)                               | ICS                                      |                      |   |
|   | <i>Breo Ellipta</i> (fluticasone furoate plus vilanterol)†             | ICS + LABA                               |                      |   |
|   | <i>DuoResp Spiromax</i> (budesonide plus formoterol)                   | ICS + LABA                               |                      |   |
|   | <i>Seretide Accuhaler</i> (fluticasone propionate plus salmeterol)     | ICS + LABA                               |                      |   |
|   | <i>Symbicort Turbuhaler</i> (budesonide plus formoterol)               | ICS + LABA                               |                      |   |
|   | <i>Anoro Ellipta</i> (umeclidinium plus vilanterol)‡                   | LAMA + LABA                              |                      | Other bronchodilator<br><br>• Must not be used in asthma or asthma-COPD overlap without an inhaled corticosteroid |
|   | <i>Bretaris Genuair</i> (aclidinium)                                   | LAMA                                     |                      |   |
|   | <i>Brimica Genuair</i> (aclidinium plus formoterol)                    | LAMA + LABA                              |                      |   |
|   | <i>Incruse Ellipta</i> (umeclidinium)‡                                 | LAMA                                     |                      |   |
|   | <i>Oxis Turbuhaler</i> (formoterol)                                    | LABA                                     |                      |   |
|   | <i>Serevent Accuhaler</i> (salmeterol)                                 | LABA                                     |                      |   |
| <i>Trelegy Ellipta</i> (fluticasone furoate plus umeclidinium bromide plus vilanterol)                  | ICS+LAMA+LABA  | Bronchodilator-ICS triple therapy (COPD) |                      |   |

| Type   | Common medicines  | Pharmacological class | Function  |
|--|---|-----------------------|---|
|  | trifenatate) <sup>†</sup>                                   |                       |   |
| <b>Dry powder inhaler (capsule)</b><br>e.g. <i>Breezhaler</i> ,<br><i>Handihaler</i> | <i>Onbrez Breezhaler</i> (indacaterol)                      | LABA                  | Other bronchodilator<br><ul style="list-style-type: none"> <li>• Must not be used in asthma or asthma-COPD overlap without an inhaled corticosteroid</li> </ul> |
|  | <i>Seebri Breezhaler</i> (glycopyrronium)                   | LAMA                  |   |
|  | <i>Spiriva Handihaler</i> (tiotropium)                      | LAMA                  |   |
|  | <i>Ultibro Breezhaler</i> (glycopyrronium plus indacaterol) | LAMA + LABA           |   |
| <b>Mist inhaler</b><br>e.g. <i>Respimat</i>  | <i>Spiolto Respimat</i> (tiotropium plus olodaterol)        | LAMA + LABA           | Other bronchodilator<br><ul style="list-style-type: none"> <li>• Must not be used in asthma or asthma-COPD overlap without an inhaled corticosteroid</li> </ul> |
|  | <i>Spiriva Respimat</i> (tiotropium)                        | LAMA                  |   |

\* This medication is classed as a reliever only when maintenance-and-reliever regimen is prescribed. Applies to lower strengths only - does not apply to Symbicort Turbuhaler 400/12 microg, DuoResp Spiromax 400/12 microg or Symbicort Rapihaler 200/6 microg (pressurised metered-dose inhaler).

<sup>†</sup>Inhaler must be discarded one month after opening.

<sup>‡</sup>Inhaler must be discarded 6 weeks after opening.

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## Choosing an inhaler device to suit the individual

### Recommendations

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When prescribing inhaled medicines, make sure the inhaler is appropriate for the patient's age, developmental stage, cognitive function, inspiratory effort and dexterity.

*Table. Types of inhaler devices for delivering asthma and COPD medicines*

Please view and print this figure separately: <http://www.astmahandbook.org.au/table/show/75>

*Table. Considerations for choice of inhaler device type when prescribing inhaled medicines*

| Clinical situation   | Consideration  |
|--|--|
| <i>Acute asthma (all patients)</i>   | Recommend use of spacer when using reliever via pMDI for acute asthma  |
| <i>Any patient using a pMDI for an inhaled corticosteroid</i>  | Recommend use of a spacer every time (except for breath-actuated pMDIs)  |
| <i>Infants and small children</i>  | Use a spacer with a facemask   |
| <i>Poor manual dexterity (e.g. weak hands or arthritis)</i>  | Consider either of: <ul style="list-style-type: none"> <li>• a <i>Haleraid</i> device with relevant pMDIs (available for salbutamol, fluticasone, fluticasone/salmeterol)</li> <li>• a breath-actuated inhaler</li> </ul>  |
| <i>Difficulty connecting spacer to pMDI (e.g. elderly patient with weakness or poor coordination)</i>  | Leave spacer connected: pharmacist can attach spacer to inhaler each time canister is replaced, and leave attached until medicine is used up. (If patient uses more than one pMDI, provide a separate spacer for each device.<br>Consider a breath-actuated inhaler. |
| <i>Inability to form a good seal around the mouthpiece of the inhaler or spacer (e.g. person with cognitive impairment or facial weakness)</i> | Consider a spacer plus age-appropriate facemask  |
| <i>Difficulty speaking or reading English</i>  | Give a physical demonstration<br><a href="#">Use videos</a><br>Use an interpreter or provide written instructions in the person's first language   |




| Clinical situation      | Consideration   |
|-------------------------|---|
| Using multiple inhalers | <p>Choose the same type for each medicine, if possible, to avoid confusion</p> <p>If not possible, train person in the correct inhaler technique for each of their devices, emphasising any key differences (e.g. speed of inhalation, shake pMDIs but not dry-powder inhalers)</p> |

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For patients who may find it difficult to use an inhaler (e.g. older patients with arthritis or weakness or people with disabilities), check the person's technique to work out which inhaler type will be easiest to use.

 How this recommendation was developed

#### Consensus

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

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## More information

### Correct use of inhaler devices

Checking and correcting inhaler technique is essential to effective asthma management.

Most patients with asthma or COPD do not use their inhalers properly,<sup>1, 2, 3, 3, 4</sup> and most have not had their technique checked or corrected by a health professional.

Incorrect inhaler technique when using maintenance treatments increases the risk of severe flare-ups and hospitalisation for people with asthma or COPD.<sup>1, 2, 5, 6, 7, 8</sup>

Poor asthma symptom control is often due to incorrect inhaler technique.<sup>9, 10</sup>

Incorrect inhaler technique when using inhaled corticosteroids increases the risk of local side effects like dysphonia and oral thrush.

The steps for using an inhaler device correctly differ between brands. Checklists of correct steps for each inhaler type and how-to videos are available from the National Asthma Council website.

- ▶ Go to: National Asthma Council Australia's [Using your inhaler](#) webpage for information, patient resources and videos on inhaler technique
- Go to: National Asthma Council Australia's information paper for health professionals on [Inhaler technique for people with asthma or COPD](#)
- Go to: NPS MedicineWise information on [Inhaler devices for respiratory medicines](#)

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### Administration of inhaled medicines in children: 1-5 years

To use inhaler devices correctly, parents and children need training in inhaler technique and in the care and cleaning of inhalers and spacers.

Children need careful supervision when taking their inhaled medicines (e.g. at preschool), especially when using a reliever for acute asthma symptoms.

#### Types of inhalers suitable for preschool children

Preschool children cannot use pressurised metered-dose inhalers properly unless a spacer is attached (with mask when necessary), because it is difficult for them to coordinate inspiratory effort with actuating the device.<sup>11</sup> Note that breath-actuated pressurised

metered-dose inhalers cannot be used with a spacer.

Dry-powder inhalers are usually ineffective for preschool children because they cannot generate sufficient inspiratory air flow.<sup>11</sup>

Drug delivery is very variable in young children with any type of inhaler, including pressurised metered dose inhalers and spacers.<sup>12</sup>

Filter studies have shown high day-to-day variability in delivered doses in preschool children.<sup>11</sup> This variation might explain fluctuations in effectiveness, even if the child's parents have been trained to use the device correctly.

### **Table. Types of inhaler devices for delivering asthma and COPD medicines**

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#### **Pressurised metered-dose inhalers plus spacers for relievers**

During acute wheezing episodes, delivery of short-acting beta2 agonist to airways is more effective with a pressurised metered-dose inhaler plus spacer than with a nebuliser.<sup>11</sup> In older children, salbutamol has also been associated with a greater increase in heart rate when delivered by nebuliser than when delivered by pressurised metered-dose inhaler plus spacer.<sup>13</sup>

When administering salbutamol to relieve asthma symptoms in a preschool child, the standard recommendation is to shake the inhaler, actuate one puff at a time into the spacer and have the child take 4–6 breaths in and out of the spacer (tidal breathing).<sup>14</sup> Fewer breaths may suffice; in children with asthma aged 2–7 years (not tested during an acute asthma episode), the number of tidal breaths needed to inhale salbutamol adequately from a spacer has been estimated at 2 breaths for small-volume spacers, 2 breaths for a spacer made from a 500-mL modified soft drink bottle, and 3 breaths for a large (Volumatic) spacer.<sup>15</sup>

#### **Face masks for infants**

When using a spacer with face mask (e.g. for an infant too young or uncooperative to be able to use a mouthpiece), effective delivery of medicine to the airways depends on a tight seal around the face.

When masks are used for inhaled corticosteroids, there is a risk of exposure to eyes and skin if the seal over the mouth and nose is not adequate. Parents should be advised to wash the child's face after administering inhaled corticosteroids by mask.

Babies are unlikely to inhale enough medicine while crying.<sup>13</sup> The use of a spacer and face mask for a crying infant may require patience and skill: the child can be comforted (e.g. held by a parent, in own pram, or sitting on the floor) while the mask is kept on, and the actuation carefully timed just before the next intake of breath. Most infants will tolerate the spacer and mask eventually. The child may be more likely to accept the spacer and mask if allowed to handle them first (and at other times), if the devices are personalised (e.g. with stickers), or if the mask has a scent associated with the mother (e.g. lip gloss). The use of a spacer with a coloured valve allows parents to see the valve move as the child breathes in and out.

► Go to: National Asthma Council Australia's information paper for health professionals on [Inhaler technique for people with asthma or COPD](#)

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#### **Administration of inhaled medicines in children: 6 years and over**

Parents, carers and children need training to use inhaler devices correctly, including inhaler technique, and care and cleaning of inhalers and spacers.

School-aged children (depending on the child's age, ability, and with individualised training) can learn to use a range of inhaler types, including manually actuated pressurised metered-dose inhalers with spacers, breath-actuated pressurised metered-dose inhalers (e.g. Autohaler), and dry-powder inhalers (e.g. Accuhaler, Turbuhaler).<sup>16, 17, 18, 19, 20</sup>

### **Table. Types of inhaler devices for delivering asthma and COPD medicines**

Please view and print this figure separately: <http://www.astmahandbook.org.au/table/show/75>

A pressurised metered-dose inhaler and spacer is an appropriate first choice for most children.<sup>18</sup>

School-aged children are unlikely to use their inhaler device correctly without careful training and repeated checking.<sup>21</sup>

► Go to: National Asthma Council Australia's [How to use a puffer and spacer for kids](#) video

Go to: National Asthma Council Australia's information paper for health professionals on [Inhaler technique for people with asthma or COPD](#)

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#### **Choosing inhaler devices for older adults**

Incorrect inhaler technique is common among older people with asthma or COPD, whether using a pressurised metered-dose inhaler or

a dry-powder inhaler, particularly with those with more severe airflow limitation.<sup>22, 23, 24, 25, 26, 27,28</sup>

### Table. Types of inhaler devices for delivering asthma and COPD medicines

Please view and print this figure separately: <http://www.asthmahandbook.org.au/table/show/75>

Inhaler devices should be used in favour of nebulisers wherever possible, just as for younger adults.<sup>23</sup> The use of nebulisers is more costly, carries a greater risk of side-effects and increases the risk of transmitting infections to other patients or to health workers. The use of ipratropium bromide via nebulisers with loose-fitting masks has been associated with pupil dilatation, blurred vision and acute glaucoma.<sup>29</sup> The use of inhaled corticosteroids by nebuliser can be associated with increased risk of skin atrophy or cataract if the seal around the mask is not good. In addition, in practice, many patients do not maintain their nebuliser adequately (e.g. they do not clean or change the bowl as often as recommended, increasing the chance of ineffective treatment or contamination).

#### Problems for older patients using inhalers

Common problems for older people include:<sup>24, 27, 30, 31, 32, 33, 34</sup>

- inadequate inspiratory flow (particularly among those with COPD), which limits ability to use dry-powder inhalers or pressurised metered-dose inhalers properly
- difficulty connecting a pressurised metered-dose inhaler to a spacer
- inability to coordinate breathing in with actuating a pressurised metered-dose inhaler
- inability to actuate a pressurised metered-dose inhaler due to arthritis or weakness of the hands
- inability to achieve a firm seal around the mouthpiece when using inhalers alone or with a spacer (particularly for patients with cognitive impairment, facial weakness, or who are missing teeth).

About half of all older people with asthma or COPD are prescribed more than one inhaler device.<sup>35</sup> As the number of prescribed devices increase, the frequency of error also increases.<sup>36</sup>

#### Inhaler options for older adults

Patients with arthritis may find it easier to use an aid (e.g. *Haleraid* hand-grip device) to help them actuate their inhaler, or use a breath-actuated inhaler. Mechanical difficulties can usually be overcome by checking each individual's technique and helping the person identify which inhaler they can use best among those available for the required medicine.

For some patients, a breath-actuated pressurised metered-dose inhaler (e.g. *Autohaler*) or breath-actuated dry-powder inhaler (e.g. *Turbuhaler* or *Accuhaler*) may be easier to use than pressurised metered-dose inhalers.<sup>31, 32</sup> However, some patients (e.g. those with severe COPD) may be unable to achieve a high enough inspiratory rate to actuate dry-powder inhalers (e.g. *Accuhaler* or *Turbuhaler*).<sup>32, 34</sup> With a breath-actuated inhaler, adequate lung doses of inhaled corticosteroids may be achieved despite poor technique.<sup>37</sup>

Older people with asthma can acquire and retain appropriate technique after specific instruction, but this instruction needs to be repeated regularly to reinforce correct inhaler technique,<sup>23</sup> just as for young people. People with cognitive impairment are likely to have problems retaining skills after instruction in the use of an inhaler.<sup>38</sup>

### Table. Considerations when choosing inhaler devices for older patients

| Problem  | Solution   |
|--|--|
| <i>Reduced maximal inspiratory flow</i>                      | Consider pMDI alone or with spacer<br>Avoid dry-powder inhalers  |
| <i>Reduced manual dexterity (e.g. due to osteoarthritis)</i> | Consider a <i>Haleraid</i> with a pMDI, where relevant (salbutamol, fluticasone, fluticasone/salmeterol)<br>Consider pMDI with small-volume spacer or breath-actuated dry-powder inhaler |
| <i>Inability to coordinate actuation and inhalation</i>      | Consider pMDI with spacer, breath-actuated pMDI or breath-actuated dry-powder inhaler<br>Avoid pMDI without spacer   |

| Problem  | Solution                  |
|--|---------------------------|
| Inability to form effective seal with lips around mouthpiece | Use spacer plus face mask |

Asset ID: 49

- ▶ Go to: National Asthma Council Australia's [Using your inhaler](#) webpage for information, patient resources and videos on inhaler technique
- Go to: National Asthma Council Australia information paper for health professionals on [Inhaler technique for people with asthma and COPD](#)

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# Training patients in inhaler technique

## Recommendations

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Make sure your own knowledge of correct technique is up to date.

 *How this recommendation was developed*

### Consensus

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

Train patients to use their inhaler devices correctly (including use of spacers, where recommended).

 *How this recommendation was developed*

### Evidence-based recommendation

Based on literature search and formulated by multidisciplinary working group

Key evidence considered:

- The Inhaler Error Steering Committee, 2013<sup>1</sup>
- Lavorini et al. 2008<sup>2</sup>
- Gillette et al. 2016<sup>3</sup>
- Bjermer L et al. 2014<sup>4</sup>
- Melani et al. 2011<sup>5</sup>
- Basheti et al. 2008<sup>6</sup>
- Bosnic-Anticevich et al. 2010<sup>7</sup>
- Capanoglu et al. 2015<sup>8</sup>
- Crane et al. 2014<sup>9</sup>
- Chorao et al. 2014<sup>10</sup>
- Wieshammer et al. 2008<sup>11</sup>
- Sestini et al. 2006<sup>12</sup>
- Broeders et al. 2003<sup>13</sup>
- Levy et al. 2016<sup>14</sup>

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Assess each patient's inhaler technique at every opportunity, even for patients who have been using the inhaler for many years.

- Have the patient demonstrate their inhaler technique, while checking against a checklist of steps for the specific device.
- Demonstrate correct technique using a placebo device and correct any specific errors identified.
- Have the patient repeat the demonstration to check they can now use the device correctly. If necessary, repeat instruction until the patient has all steps correct.
- Provide the checklist as a reminder, and write down or highlight any steps that were done incorrectly (e.g. on a sticker attached to their inhaler or on a pictorial instruction sheet).

Note: Watch the person use their inhaler – don't just ask if they think they know how to use it properly.

Checklists of steps, and videos demonstrating correct technique, for various types of inhalers are available on National Asthma Council Australia's website.

- ▶ Go to: National Asthma Council Australia's [How-to videos](#) webpage for information and videos on inhaler technique
- Go to: National Asthma Council Australia's information paper for health professionals on [Inhaler technique for people with asthma](#)

or COPD

Go to: NPS MedicineWise's [Asthma: inhaler device checklist](#)

### How this recommendation was developed

#### Evidence-based recommendation

Based on literature search and formulated by multidisciplinary working group

Key evidence considered:

- Basheti *et al.* 2013<sup>15</sup>
- National Asthma Council Australia, 2018<sup>16</sup>
- The Inhaler Error Steering Committee, 2013<sup>17</sup>
- Basheti *et al.* 2008<sup>18</sup>
- Basheti *et al.* 2017<sup>6</sup>
- Bosnic-Anticevich *et al.* 2010<sup>7</sup>
- Capanoglu *et al.* 2015<sup>8</sup>
- Crane *et al.* 2014<sup>9</sup>
- Giraud *et al.* 2011<sup>10</sup>
- Lavorini 2014<sup>19</sup>
- Newman 2014<sup>20</sup>
- Hesso *et al.* 2016<sup>21</sup>

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Keep your advice and explanations relevant to the person and appropriate to their age, cultural background and education.

### How this recommendation was developed

#### Consensus

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

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For people instructed to use a spacer with their inhaler, ask whether they sometimes or often use the inhaler alone. Strongly encourage the use of spacers and emphasise that using the spacer is an important part of correct technique for best results.

### How this recommendation was developed

#### Consensus

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

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## More information

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### *Correct use of inhaler devices*

Checking and correcting inhaler technique is essential to effective asthma management.

Most patients with asthma or COPD do not use their inhalers properly,<sup>22, 23,24, 24, 25</sup> and most have not had their technique checked or corrected by a health professional.

Incorrect inhaler technique when using maintenance treatments increases the risk of severe flare-ups and hospitalisation for people with asthma or COPD.<sup>22, 23, 5, 14, 26, 27</sup>

Poor asthma symptom control is often due to incorrect inhaler technique.<sup>28, 29</sup>

Incorrect inhaler technique when using inhaled corticosteroids increases the risk of local side effects like dysphonia and oral thrush.

The steps for using an inhaler device correctly differ between brands. Checklists of correct steps for each inhaler type and how-to videos are available from the National Asthma Council website.

- ▶ Go to: National Asthma Council Australia's [Using your inhaler](#) webpage for information, patient resources and videos on inhaler technique
- Go to: National Asthma Council Australia's information paper for health professionals on [Inhaler technique for people with asthma or COPD](#)
- Go to: NPS MedicineWise information on [Inhaler devices for respiratory medicines](#)

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### *Administration of inhaled medicines in children: 1-5 years*

To use inhaler devices correctly, parents and children need training in inhaler technique and in the care and cleaning of inhalers and spacers.

Children need careful supervision when taking their inhaled medicines (e.g. at preschool), especially when using a reliever for acute asthma symptoms.

#### **Types of inhalers suitable for preschool children**

Preschool children cannot use pressurised metered-dose inhalers properly unless a spacer is attached (with mask when necessary), because it is difficult for them to coordinate inspiratory effort with actuating the device.<sup>30</sup> Note that breath-actuated pressurised metered-dose inhalers cannot be used with a spacer.

Dry-powder inhalers are usually ineffective for preschool children because they cannot generate sufficient inspiratory air flow.<sup>30</sup>

Drug delivery is very variable in young children with any type of inhaler, including pressurised metered dose inhalers and spacers.<sup>31</sup> Filter studies have shown high day-to-day variability in delivered doses in preschool children.<sup>30</sup> This variation might explain fluctuations in effectiveness, even if the child's parents have been trained to use the device correctly.

#### **Table. Types of inhaler devices for delivering asthma and COPD medicines**

Please view and print this figure separately: <http://www.asthmahandbook.org.au/table/show/75>

#### **Pressurised metered-dose inhalers plus spacers for relievers**

During acute wheezing episodes, delivery of short-acting beta2 agonist to airways is more effective with a pressurised metered-dose inhaler plus spacer than with a nebuliser.<sup>30</sup> In older children, salbutamol has also been associated with a greater increase in heart rate when delivered by nebuliser than when delivered by pressurised metered-dose inhaler plus spacer.<sup>32</sup>

When administering salbutamol to relieve asthma symptoms in a preschool child, the standard recommendation is to shake the inhaler, actuate one puff at a time into the spacer and have the child take 4–6 breaths in and out of the spacer (tidal breathing).<sup>33</sup> Fewer breaths may suffice; in children with asthma aged 2–7 years (not tested during an acute asthma episode), the number of tidal breaths needed to inhale salbutamol adequately from a spacer has been estimated at 2 breaths for small-volume spacers, 2 breaths for a spacer made from a 500-mL modified soft drink bottle, and 3 breaths for a large (Volumatic) spacer.<sup>34</sup>

#### **Face masks for infants**

When using a spacer with face mask (e.g. for an infant too young or uncooperative to be able to use a mouthpiece), effective delivery of medicine to the airways depends on a tight seal around the face.

When masks are used for inhaled corticosteroids, there is a risk of exposure to eyes and skin if the seal over the mouth and nose is not adequate. Parents should be advised to wash the child's face after administering inhaled corticosteroids by mask.

Babies are unlikely to inhale enough medicine while crying.<sup>32</sup> The use of a spacer and face mask for a crying infant may require patience and skill: the child can be comforted (e.g. held by a parent, in own pram, or sitting on the floor) while the mask is kept on, and the actuation carefully timed just before the next intake of breath. Most infants will tolerate the spacer and mask eventually. The child may be more likely to accept the spacer and mask if allowed to handle them first (and at other times), if the devices are personalised (e.g. with stickers), or if the mask has a scent associated with the mother (e.g. lip gloss). The use of a spacer with a coloured valve allows parents to see the valve move as the child breathes in and out.

- ▶ Go to: National Asthma Council Australia's information paper for health professionals on [Inhaler technique for people with asthma or COPD](#)

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### *Administration of inhaled medicines in children: 6 years and over*

Parents, carers and children need training to use inhaler devices correctly, including inhaler technique, and care and cleaning of inhalers and spacers.



School-aged children (depending on the child's age, ability, and with individualised training) can learn to use a range of inhaler types, including manually actuated pressurised metered-dose inhalers with spacers, breath-actuated pressurised metered-dose inhalers (e.g. Autohaler), and dry-powder inhalers (e.g. Accuhaler, Turbuhaler).<sup>3, 8, 35, 36, 37</sup>

### Table. Types of inhaler devices for delivering asthma and COPD medicines

Please view and print this figure separately: <http://www.asthmahandbook.org.au/table/show/75>

A pressurised metered-dose inhaler and spacer is an appropriate first choice for most children.<sup>35</sup>

School-aged children are unlikely to use their inhaler device correctly without careful training and repeated checking.<sup>38</sup>

► Go to: National Asthma Council Australia's [How to use a puffer and spacer for kids](#) video

Go to: National Asthma Council Australia's information paper for health professionals on [Inhaler technique for people with asthma or COPD](#)

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# Considerations when using inhaled reliever or preventer medicines

## Recommendations

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Advise patients and carers that new inhalers must be primed before first use, by firing a number of actuations into the air.

Note: Instructions differ between products, so they should follow the manufacturer's instructions


 *How this recommendation was developed*

### Consensus

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

Advise patients/carers that inhalers should be stored below 30°C and should not be left in cars.

Note: Some inhalers should be brought to room temperature before use if they have been stored in a refrigerator. Patients and parents/carers should read the manufacturer's instructions for storage and use.

 *How this recommendation was developed*

### Consensus

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

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For patients who use a pressurised metered-dose inhaler ('puffer') for their reliever (e.g. *Airomir, Asmol, Ventolin*), advise patients or parents how to take the medicine during asthma symptoms:


- For children, use a spacer whenever possible.
- Use a spacer for adults whose symptoms are not relieved when using the inhaler on its own, and whenever possible for acute asthma.
- Shake the puffer before every puff (whether using a spacer or not). If using a spacer, either disconnect the puffer and shake it before reconnecting to spacer, or take the spacer mouthpiece out of the mouth and shake the puffer while still connected to the spacer.

### Notes

Provide written instructions.

In an emergency, it may not be practical to disconnect and shake before each puff.

► See: [First aid instructions for patients, parents and community members](#)

 *How this recommendation was developed*

### Consensus

Based on clinical experience and expert opinion (informed by evidence, where available), with particular reference to the following source(s):

- Barry and O'Callaghan 1994<sup>1</sup>
- Cyr *et al.* 1991<sup>2</sup>
- Laube *et al.* 2011<sup>3</sup>
- National Asthma Council Australia 2008<sup>4</sup>
- Rau *et al.* 1996<sup>5</sup>

In clinical settings, when delivering salbutamol by pressurised metered-dose inhaler for patients with acute asthma:

- Use a spacer.
- Shake the puffer before firing each dose into the spacer.

*Table. Using pressurised metered-dose inhalers in acute asthma*

#### Administration of salbutamol by health professionals for a patient with acute asthma

1. Use a salbutamol pressurised metered-dose inhaler (100 microg/actuation) with a spacer that has already been prepared (see note).
2. Shake inhaler and insert upright into spacer.
3. Place mouthpiece between the person's teeth and ask them to seal lips firmly around mouthpiece.
4. Fire one puff into the spacer.
5. Tell person to take 4 breaths in and out of the spacer.
6. Remove the spacer from mouth. Shake the inhaler after each puff before actuating again. (This can be done without detaching the pressurised metered-dose inhaler from the spacer.)

#### Notes

The process is repeated until the total dose is given. Different doses are recommended for patients and carers giving asthma first aid in the community.

New plastic spacers should be washed with detergent to remove electrostatic charge (and labelled), so they are ready for use when needed. In an emergency situation, if a pre-treated spacer is not available, prime the spacer before use by firing at least 10 puffs of salbutamol into the spacer. (This is an arbitrary number of actuations in the absence of evidence that would enable a precise guideline.)

Priming or washing spacers to reduce electrostatic charge before using for the first time is only necessary for standard plastic spacers. Treatment to reduce electrostatic charge is not necessary for polyurethane/antistatic polymer spacers (e.g. Able A2A, AeroChamber Plus, La Petite E-Chamber, La Grande E-Chamber) or disposable cardboard spacers (e.g. DispozABLE, LiteAire).

For small children who cannot form a tight seal with their lips around the spacer mouthpiece, attach a well-fitted mask to the spacer.

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#### *How this recommendation was developed*

##### Consensus

Based on clinical experience and expert opinion (informed by evidence, where available), with particular reference to the following source(s):

- Barry and O'Callaghan 1994<sup>1</sup>
- Cyr *et al.* 1991<sup>2</sup>
- Laube *et al.* 2011<sup>3</sup>
- Rau *et al.* 1996<sup>5</sup>

Advise all patients using inhaled corticosteroids to rinse their mouth with water and spit after each dose, if possible.

## How this recommendation was developed

### Consensus

Based on clinical experience and expert opinion (informed by evidence, where available), with particular reference to the following source(s):

- National Asthma Council Australia, 2008<sup>4</sup>
- Rachelefsky *et al.* 2007<sup>6</sup>
- Yokoyama *et al.* 2007<sup>7</sup>

## More information

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### *Correct use of inhaler devices*

Checking and correcting inhaler technique is essential to effective asthma management.

Most patients with asthma or COPD do not use their inhalers properly,<sup>8, 9,10, 10, 11</sup> and most have not had their technique checked or corrected by a health professional.

Incorrect inhaler technique when using maintenance treatments increases the risk of severe flare-ups and hospitalisation for people with asthma or COPD.<sup>8, 9, 12, 13, 14, 15</sup>

Poor asthma symptom control is often due to incorrect inhaler technique.<sup>16, 17</sup>

Incorrect inhaler technique when using inhaled corticosteroids increases the risk of local side effects like dysphonia and oral thrush.

The steps for using an inhaler device correctly differ between brands. Checklists of correct steps for each inhaler type and how-to videos are available from the National Asthma Council website.

- ▶ Go to: National Asthma Council Australia's [Using your inhaler](#) webpage for information, patient resources and videos on inhaler technique
- Go to: National Asthma Council Australia's information paper for health professionals on [Inhaler technique for people with asthma or COPD](#)
- Go to: NPS MedicineWise information on [Inhaler devices for respiratory medicines](#)

*Last reviewed version 2.0*

### *Technical notes: pressurised metered-dose inhalers with spacers*

Manufacturers of most pressurised metered-dose delivery devices recommend shaking the device before actuating. The physical characteristics of each formulation, including the effects of shaking, differ widely,<sup>2</sup> but for simplicity it is best always to recommend shaking of pressurised metered-dose inhalers.

Pressurised metered-dose inhalers (except for those that are breath-actuated) can be used with a spacer. When a spacer is used with a pressurised metered-dose inhaler, delivery of the medicine to the patient's airways is maximised when the patient takes a slow, deep breath from the spacer after each actuation.<sup>1, 5</sup> Multiple actuations of a pressurised metered-dose inhaler into a spacer can reduce the amount of respirable medicine available because aerosol particles can agglomerate into larger particles or become attached to the spacer walls.<sup>1</sup>

Therefore, the ideal way to deliver inhaled medicines via pressurised metered-dose inhaler and spacer is to shake the device, ask the person to breathe out all the way into the spacer, actuate a single puff into the spacer, and have the person immediately take a slow deep breath from the spacer, then hold their breath for 5 seconds. This process should be repeated until the total intended number of actuations is taken. Patients should be trained to follow these instructions when using their inhalers. Inhaling slowly with a single breath maximises delivery of the medicine to the lungs and minimises deposition in the upper airways when using a manually actuated pressurised metered-dose inhaler with or without a spacer, or when using a breath-actuated pressurised metered-dose inhaler.<sup>3</sup> However, slow breathing may not be possible for patients with acute asthma. Tidal breathing through the spacer (e.g. four breaths in and out without removing the spacer) is used in acute asthma and for very young children. First aid instructions should include how to use inhaler and spacer.

In practice, optimal delivery of inhaled medicines involves a balance between maximising the proportion of respirable medicine and maximising efficiency of inhalation by the patient within real-world constraints. The optimal delivery of salbutamol in real-world circumstances is not well defined. For day-to-day use of salbutamol, most adults gain sufficient relief from symptoms when using a pressurised metered-dose inhaler on its own. A spacer may only be needed during a flare-up. By contrast, the use of a spacer is always recommended for inhaled corticosteroids delivered by manually actuated pressurised metered-dose inhalers, to reduce the risk of local adverse effects and increase delivery to the airways.

Many available in vitro studies of aerosol particle deposition in the airways were performed using older CFC-propelled formulations, which are now obsolete. Similar studies have not been performed for current non-CFC pressurised metered-dose inhalers.

► Go to: National Asthma Council Australia's [first aid charts](#)

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### *Administration of inhaled medicines in children: 1-5 years*

To use inhaler devices correctly, parents and children need training in inhaler technique and in the care and cleaning of inhalers and spacers.

Children need careful supervision when taking their inhaled medicines (e.g. at preschool), especially when using a reliever for acute asthma symptoms.

#### **Types of inhalers suitable for preschool children**

Preschool children cannot use pressurised metered-dose inhalers properly unless a spacer is attached (with mask when necessary), because it is difficult for them to coordinate inspiratory effort with actuating the device.<sup>18</sup> Note that breath-actuated pressurised metered-dose inhalers cannot be used with a spacer.

Dry-powder inhalers are usually ineffective for preschool children because they cannot generate sufficient inspiratory air flow.<sup>18</sup>

Drug delivery is very variable in young children with any type of inhaler, including pressurised metered dose inhalers and spacers.<sup>19</sup>

Filter studies have shown high day-to-day variability in delivered doses in preschool children.<sup>18</sup> This variation might explain fluctuations in effectiveness, even if the child's parents have been trained to use the device correctly.

#### **Table. Types of inhaler devices for delivering asthma and COPD medicines**

Please view and print this figure separately: <http://www.asthmahandbook.org.au/table/show/75>

#### **Pressurised metered-dose inhalers plus spacers for relievers**

During acute wheezing episodes, delivery of short-acting beta2 agonist to airways is more effective with a pressurised metered-dose inhaler plus spacer than with a nebuliser.<sup>18</sup> In older children, salbutamol has also been associated with a greater increase in heart rate when delivered by nebuliser than when delivered by pressurised metered-dose inhaler plus spacer.<sup>20</sup>

When administering salbutamol to relieve asthma symptoms in a preschool child, the standard recommendation is to shake the inhaler, actuate one puff at a time into the spacer and have the child take 4–6 breaths in and out of the spacer (tidal breathing).<sup>21</sup> Fewer breaths may suffice; in children with asthma aged 2–7 years (not tested during an acute asthma episode), the number of tidal breaths needed to inhale salbutamol adequately from a spacer has been estimated at 2 breaths for small-volume spacers, 2 breaths for a spacer made from a 500-mL modified soft drink bottle, and 3 breaths for a large (Volumatic) spacer.<sup>22</sup>

#### **Face masks for infants**

When using a spacer with face mask (e.g. for an infant too young or uncooperative to be able to use a mouthpiece), effective delivery of medicine to the airways depends on a tight seal around the face.

When masks are used for inhaled corticosteroids, there is a risk of exposure to eyes and skin if the seal over the mouth and nose is not adequate. Parents should be advised to wash the child's face after administering inhaled corticosteroids by mask.

Babies are unlikely to inhale enough medicine while crying.<sup>20</sup> The use of a spacer and face mask for a crying infant may require patience and skill: the child can be comforted (e.g. held by a parent, in own pram, or sitting on the floor) while the mask is kept on, and the actuation carefully timed just before the next intake of breath. Most infants will tolerate the spacer and mask eventually. The child may be more likely to accept the spacer and mask if allowed to handle them first (and at other times), if the devices are personalised (e.g. with stickers), or if the mask has a scent associated with the mother (e.g. lip gloss). The use of a spacer with a coloured valve allows parents to see the valve move as the child breathes in and out.

► Go to: National Asthma Council Australia's information paper for health professionals on [Inhaler technique for people with asthma or COPD](#)

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### *Administration of inhaled medicines in children: 6 years and over*

Parents, carers and children need training to use inhaler devices correctly, including inhaler technique, and care and cleaning of inhalers and spacers.

School-aged children (depending on the child's age, ability, and with individualised training) can learn to use a range of inhaler types, including manually actuated pressurised metered-dose inhalers with spacers, breath-actuated pressurised metered-dose inhalers (e.g. Autohaler), and dry-powder inhalers (e.g. Accuhaler, Turbuhaler).<sup>23, 24, 25, 26, 27</sup>

## Table. Types of inhaler devices for delivering asthma and COPD medicines

Please view and print this figure separately: <http://www.asthmahandbook.org.au/table/show/75>

A pressurised metered-dose inhaler and spacer is an appropriate first choice for most children.<sup>25</sup>

School-aged children are unlikely to use their inhaler device correctly without careful training and repeated checking.<sup>28</sup>

► Go to: National Asthma Council Australia's [How to use a puffer and spacer for kids](#) video

Go to: National Asthma Council Australia's information paper for health professionals on [Inhaler technique for people with asthma or COPD](#)

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## Use and care of spacers

### Recommendations

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For patients using standard plastic spacers (e.g. *Able Spacer Universal*, *Breath-A-Tech*, *Volumatic*) or antistatic polymer spacers (e.g. *Able A2A*, *AeroChamber Plus*, *Breathe Eazy*, *La Petite E-Chamber*, *La Grande E-Chamber*, *OptiChamber Diamond*), advise patients and parents to clean the spacer monthly and after the resolution of any respiratory tract infection.

To clean a spacer:

- Dismantle as per manufacturer's instructions, if necessary.
- Wash parts in warm water with liquid dishwashing detergent.
- Allow to air dry without rinsing.
- Reassemble carefully, if necessary.

Note: Do not dry spacers with a cloth or paper towel. Wiping can increase the electrostatic charge on the inside of the spacer, which can reduce the available dose.

Table. Types of spacers


| Name                       | Material                   | Cleaning necessary | Priming necessary before first use* |
|----------------------------|----------------------------|--------------------|-------------------------------------|
| <i>Able A2A</i>            | Antistatic polymer         | Yes                | No                                  |
| <i>AeroChamber Plus</i>    | Polycarbonate polyurethane | Yes                | No                                  |
| <i>Breath-A-Tech</i>       | Plastic                    | Yes                | Yes                                 |
| <i>DispozABLE</i>          | Cardboard                  | No                 | No                                  |
| <i>La Grande E-Chamber</i> | Polycarbonate polyurethane | Yes                | No                                  |
| <i>LiteAire</i>            | Cardboard                  | No                 | No                                  |
| <i>La Petite E-Chamber</i> | Polycarbonate polyurethane | Yes                | No                                  |
| <i>Volumatic</i>           | Plastic                    | Yes                | Yes                                 |

Washing: disassemble (if necessary), wash in warm water and dishwashing detergent, then allow to air dry without rinsing or wiping. Reassemble carefully.

Priming plastic spacers: wash and allow to dry (as above) before first use, to reduce static charge. If an unwashed plastic spacer needs to be used immediately, fire multiple (at least 10) actuations of medicine into the spacer, following manufacturer's instructions. (This is an arbitrary number of actuations in the absence of evidence that would enable a precise guideline.)

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 *How this recommendation was developed*

## Consensus

Based on clinical experience and expert opinion (informed by evidence, where available), with particular reference to the following source(s):

- Berg, 1995<sup>1</sup>
- Brand *et al.* 2008<sup>2</sup>
- Dompeling *et al.* 2001<sup>3</sup>
- National Asthma Council Australia, 2008<sup>4</sup>

**Advise patients and parents to wash standard plastic spacers (e.g. *Able Spacer Universal*, *Breath-A-Tech*, *Volumatic*) before first use to reduce electrostatic charge. This should be done by disassembling if necessary, washing in warm water and dishwashing detergent, then allowing to air dry without rinsing or wiping.**

**If a new plastic spacer must be used immediately, it can be primed by firing multiple (at least 10) puffs of medicine into the spacer. (This is an arbitrary number of actuations in the absence of evidence that would enable a precise guideline.) Patients should follow the manufacturer's instructions.**

**Note: Priming or washing spacers to reduce electrostatic charge before using for the first time is only necessary for standard plastic spacers (e.g. *Able Spacer Universal*, *Breath-A-Tech*, *Volumatic*). It is not necessary for antistatic polymer spacers (e.g. *Able A2A*, *AeroChamber Plus*, *Breathe Eazy*, *La Petite E-Chamber*, *La Grande E-Chamber*, *Space Chamber*, *OptiChamber Diamond*), or disposable cardboard spacers.**

Table. Types of spacers

| Name                       | Material                   | Cleaning necessary | Priming necessary before first use* |
|----------------------------|----------------------------|--------------------|-------------------------------------|
| <i>Able A2A</i>            | Antistatic polymer         | Yes                | No                                  |
| <i>AeroChamber Plus</i>    | Polycarbonate polyurethane | Yes                | No                                  |
| <i>Breath-A-Tech</i>       | Plastic                    | Yes                | Yes                                 |
| <i>DispozABLE</i>          | Cardboard                  | No                 | No                                  |
| <i>La Grande E-Chamber</i> | Polycarbonate polyurethane | Yes                | No                                  |
| <i>LiteAire</i>            | Cardboard                  | No                 | No                                  |
| <i>La Petite E-Chamber</i> | Polycarbonate polyurethane | Yes                | No                                  |
| <i>Volumatic</i>           | Plastic                    | Yes                | Yes                                 |

**Washing: disassemble (if necessary), wash in warm water and dishwashing detergent, then allow to air dry without rinsing or wiping. Reassemble carefully.**

**Priming plastic spacers: wash and allow to dry (as above) before first use, to reduce static charge. If an unwashed plastic spacer needs to be used immediately, fire multiple (at least 10) actuations of medicine into the spacer, following manufacturer's instructions. (This is an arbitrary number of actuations in the absence of evidence that would enable a precise guideline.)**

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## How this recommendation was developed

### Consensus

Based on clinical experience and expert opinion (informed by evidence, where available), with particular reference to the following source(s):

- Berg, 1995<sup>1</sup>
- Brand *et al.* 2008<sup>2</sup>
- Dompeling *et al.* 2001<sup>3</sup>
- National Asthma Council Australia, 2008<sup>4</sup>

Ask patients to bring their spacer with them to be checked every 6–12 months. Check that there are no cracks and that the valve is working.

 *How this recommendation was developed*

#### Consensus

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

## More information

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### *Preparation of new spacers before first use*

Spacers are made of plastic, antistatic polymer/polycarbonate polyurethane, or cardboard.

#### *Plastic spacers (e.g. Breath-A-Tech, Volumatic)*

Electrostatic surface charge on new spacers made of plastic (e.g. *Breath-A-Tech, Volumatic*) reduces the proportion of medicine available for delivery to the airway. This charge can be reduced by washing the plastic spacer in dishwashing liquid and allowing it to air dry or drip-dry without rinsing or wiping.<sup>2</sup>

Alternatively, priming the spacer by actuating the device several times into the spacer also overcomes the charge, but this wastes medicine. The optimal number of actuations for priming is not known and the findings of *in vitro* studies vary widely. One study (using older, CFC-based formulations of asthma medicines) reported that up to 40 actuations fired into a new plastic spacer overcame the effect of the electrostatic charge.<sup>1</sup> Others have concluded that the electrostatic charge on plastic spacers does not reduce *in vivo* efficacy of bronchodilator therapy in children with asthma.<sup>3</sup> The number of actuations necessary may be known when the results of recent studies become available.

When a new plastic spacer must be used immediately (e.g. for a person with asthma symptoms), patients, parents and carers should follow the manufacturer's priming instructions. In hospitals and emergency departments, a new spacer that has not been pre-treated by washing can be primed using multiple (at least 10) puffs of salbutamol. (This is an arbitrary number of actuations in the absence of evidence that would enable a precise guideline.)

#### *Non-plastic spacers*

Disposable cardboard spacers (e.g. DispozABLE, LiteAire) and polyurethane/antistatic polymer spacers (e.g. *Able A2A, AeroChamber Plus, La Petite E-Chamber, La Grande E-Chamber*) do not require preparation before first use.<sup>2</sup>

**Note:** The term 'priming' is also used for the preparation process that is necessary for new pressurised metered-dose inhalers that have not been used for more than a week. This involves first actuating the inhaler into the air (away from the patient). Users should follow the manufacturer's instructions for the particular brand of inhaler, which specify the number of actuations required.

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### *Technical notes: pressurised metered-dose inhalers with spacers*

Manufacturers of most pressurised metered-dose delivery devices recommend shaking the device before actuating. The physical characteristics of each formulation, including the effects of shaking, differ widely,<sup>5</sup> but for simplicity it is best always to recommend shaking of pressurised metered-dose inhalers.

Pressurised metered-dose inhalers (except for those that are breath-actuated) can be used with a spacer. When a spacer is used with a pressurised metered-dose inhaler, delivery of the medicine to the patient's airways is maximised when the patient takes a slow, deep breath from the spacer after each actuation.<sup>6,7</sup> Multiple actuations of a pressurised metered-dose inhaler into a spacer can reduce the amount of respirable medicine available because aerosol particles can agglomerate into larger particles or become attached to the spacer walls.<sup>6</sup>

Therefore, the ideal way to deliver inhaled medicines via pressurised metered-dose inhaler and spacer is to shake the device, ask the person to breathe out all the way into the spacer, actuate a single puff into the spacer, and have the person immediately take a slow deep breath from the spacer, then hold their breath for 5 seconds. This process should be repeated until the total intended number of

actuations is taken. Patients should be trained to follow these instructions when using their inhalers. Inhaling slowly with a single breath maximises delivery of the medicine to the lungs and minimises deposition in the upper airways when using a manually actuated pressurised metered-dose inhaler with or without a spacer, or when using a breath-actuated pressurised metered-dose inhaler.<sup>8</sup> However, slow breathing may not be possible for patients with acute asthma. Tidal breathing through the spacer (e.g. four breaths in and out without removing the spacer) is used in acute asthma and for very young children. First aid instructions should include how to use inhaler and spacer.

In practice, optimal delivery of inhaled medicines involves a balance between maximising the proportion of respirable medicine and maximising efficiency of inhalation by the patient within real-world constraints. The optimal delivery of salbutamol in real-world circumstances is not well defined. For day-to-day use of salbutamol, most adults gain sufficient relief from symptoms when using a pressurised metered-dose inhaler on its own. A spacer may only be needed during a flare-up. By contrast, the use of a spacer is always recommended for inhaled corticosteroids delivered by manually actuated pressurised metered-dose inhalers, to reduce the risk of local adverse effects and increase delivery to the airways.

Many available in vitro studies of aerosol particle deposition in the airways were performed using older CFC-propelled formulations, which are now obsolete. Similar studies have not been performed for current non-CFC pressurised metered-dose inhalers.

► Go to: National Asthma Council Australia's [first aid charts](#)

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