Note:
This guideline provides advice of a general nature. This statewide guideline has been prepared to promote and facilitate standardisation and consistency of practice, using a multidisciplinary approach. The guideline is based on a review of published evidence and expert opinion. Information in this statewide guideline is current at the time of publication.
SA Health does not accept responsibility for the quality or accuracy of material on websites linked from this site and does not sponsor, approve or endorse materials on such links.
Health practitioners in the South Australian public health sector are expected to review specific details of each patient and professionally assess the applicability of the relevant guideline to that clinical situation. If for good clinical reasons, a decision is made to depart from the guideline, the responsible clinician must document in the patient’s medical record, the decision made, by whom, and detailed reasons for the departure from the guideline.
This statewide guideline does not address all the elements of clinical practice and assumes that the individual clinicians are responsible for discussing care with consumers in an environment that is culturally appropriate and which enables respectful confidential discussion. This includes:
• The use of interpreter services where necessary,
• Advising consumers of their choice and ensuring informed consent is obtained,
• Providing care within scope of practice, meeting all legislative requirements and maintaining standards of professional conduct, and
• Documenting all care in accordance with mandatory and local requirements

Explanation of the aboriginal artwork:
The aboriginal artwork used symbolises the connection to country and the circle shape shows the strong relationships amongst families and the aboriginal culture. The horse shoe shape design shown in front of the generic statement symbolises a woman and those enclosing a smaller horse shoe shape depicts a pregnant woman. The smaller horse shoe shape in this instance represents the unborn child. The artwork shown before the specific statements within the document symbolises a footprint and demonstrates the need to move forward together in unison.

Cultural safety enhances clinical safety.
To secure the best health outcomes, clinicians must provide a culturally safe health care experience for Aboriginal children, young people and their families. Aboriginal children are born into strong kinship structures where roles and responsibilities are integral and woven into the social fabric of Aboriginal societies.

Australian Aboriginal culture is the oldest living culture in the world, yet Aboriginal people currently experience the poorest health outcomes when compared to non-Aboriginal Australians.

It remains a national disgrace that Australia has one of the highest youth suicide rates in the world. The over representation of Aboriginal children and young people in out of home care and juvenile detention and justice system is intolerable.

The cumulative effects of forced removal of Aboriginal children, poverty, exposure to violence, historical and transgenerational trauma, the ongoing effects of past and present systemic racism, culturally unsafe and discriminatory health services are all major contributors to the disparities in Aboriginal health outcomes.

Clinicians can secure positive long term health and wellbeing outcomes by making well informed clinical decisions based on cultural considerations.

The term ‘Aboriginal’ is used to refer to people who identify as Aboriginal, Torres Strait Islanders, or both Aboriginal and Torres Strait Islander. This is done because the people indigenous to South Australia are Aboriginal and we respect that many Aboriginal people prefer the term ‘Aboriginal’. We also acknowledge and respect that many Aboriginal South Australians prefer to be known by their specific language group(s).
### Purpose and Scope of PCPG

The Acute Asthma in Children Guideline is primarily aimed at medical staff working in any of primary care, local, regional, general or tertiary hospitals. It may however assist the care provided by other clinicians such as nurses. The information is current at the time of publication and provides a minimum standard for the assessment (including investigations) and management of Acute Asthma in Children; it does not replace or remove clinical judgement or the professional care and duty necessary for each specific case.

### Management of acute asthma in children

**Figure – Managing acute asthma in children.**


---

**ASSESS SEVERITY AND START BRONchodilATOR**

<table>
<thead>
<tr>
<th>Severe</th>
<th>Life-threatening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any of: unable to speak in sentences, visibly breathless, increased work of breathing, oxygen saturation 90 - 94%</td>
<td>Any of: drowsy, collapsed, exhausted, cyanotic, poor respiratory effort, oxygen saturation less than 90%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mild/Moderate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Any of: able to speak in sentences, can walk and speak whole sentences in one breath (young children can move about and speak in phrases)</td>
<td></td>
</tr>
</tbody>
</table>

- **Give salbutamol (100 microg per actuation) via pMDI plus spacer (plus mask for younger children)**
- 6 years and over: 4 - 12 puffs
- 1 - 5 years: 2 - 6 puffs

- **Asthma is least likely to be the cause of wheezing in infants less than 12 months old. Monitor closely. If symptoms do not respond, reconsider the diagnosis and contact a paediatrician.**

---

**ARRANGE IMMEDIATE TRANSFER TO HIGHER-LEVEL CARE**

- Notify senior staff
- Ventilate if required (NPPV or intubate and ventilate)

**Figure. Initial management of life-threatening acute asthma in adults and children.**
Acute Asthma in Children

**WITHIN MINUTES**

**REASSESS SEVERITY**

Table: Secondary severity assessment of acute asthma in adults and children 6 years and over

- In non-acute care settings, arrange immediate transfer if no improvement

**CONTINUE BRONchodilator**

- Repeat dose every 20-30 mins for first hour if needed (or sooner as needed)
- Repeat dose every 20 minutes for first hour (3 doses) or sooner as needed

- Continuous nebulization until breathing difficulty improves. Then consider changing to pMDI plus spacer or intermittent nebulizer (see as severe for severe)

**IF POOR RESPONSE, ADD IV MAGNESIUM SULFATE**

- 2 years and over: 0.1-0.2 mmol/L (maximum 10 mmol/L) diluted in a compatible solution as a single IV infusion over 30 minutes.

**CONSIDER OTHER ADD-ON TREATMENT OPTIONS**

Table: Add-on treatment options for acute asthma

- Arrange immediate transfer to higher-level care if no improvement or worsening

**WITHIN FIRST HOUR**

**START SYSTEMIC CORTICOSTEROIDS**

- Oral prednisolone 1 mg/kg (max 50 mg) for 3-5 days
- OR, if oral route not possible:
  - Hydrocortisone IV 1 mg/kg (max 100 mg) every 6 hours on day 1, then every 12 hours on day 2, then once on day 3
  - OR
  - Methylprednisolone IV 1 mg/kg (max 60 mg) every 6 hours on day 1, then every 12 hours on day 2, then once on day 3

For children 1-5 years, avoid systemic corticosteroids if mild/moderate wheezing responds to initial bronchodilator treatment

**1 HOUR**

**REASSESS RESPONSE TO TREATMENT (1 HOUR AFTER STARTING BRONCHODILATOR)**

- NO breathing difficulty
- Breathing difficulty persists

**AFTER 1-HOUR CHECK**

No breathing difficulty

**ARRANGE HOSPITAL ADMISSION**

**CONTINUE BRONCHODILATOR AND ADD-ON TREATMENT**

Table: Add-on treatment options for acute asthma

Breathing difficulty persists

**OBSERVE**

for more than 1 hour after breathing difficulty resolves

**POST-ACUTE CARE**

- Ensure parents are able to monitor and manage asthma at home
- Provide oral prednisolone for 3 days
- Ensure child has regular inhaled preventer if indicated
- Check and coach in correct inhaler technique
- Provide spacer if needed
- Provide written asthma action plan
- Advise arrange follow-up review

**TRANSFER TO HIGHER-LEVEL CARE**

**OR**

**DISCUSS TRANSFER OR RETRIEVAL WITH SENIOR MEDICAL STAFF**

**Breathing difficulty for more than one hour**
Figure • Initial management of life-threatening acute asthma in children

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Acute Asthma in Children

Important points

Acute asthma management in children, adolescents and adults is based on:

> assessing severity (mild/moderate, severe or life-threatening) while starting bronchodilator treatment immediately
> administering oxygen therapy if peripheral capillary oxygen saturation measured by pulse oximetry (SpO2) is less than 92% in adults or less than 95% in children
> completing observations and assessments (when appropriate, based on clinical priorities determined by baseline severity)
> administering systemic corticosteroids within the first hour of treatment
> repeatedly reassessing response to treatment and either continuing treatment or adding on treatments, until acute asthma has resolved or patient has been transferred to an intensive care unit or admitted to hospital
> observing the patient for at least 3 hours after respiratory distress or increased work of breathing has resolved
> providing post-acute care and arranging follow-up to reduce the risk of future flare-ups.

Notes: The classification of acute asthma severity differs between clinical settings. The definitions of mild/moderate, severe and life-threatening acute asthma used in the Australian Asthma Handbook may differ from those of some published clinical trials and other guidelines. The terms ‘exacerbation’, ‘flare-up’, ‘attack’ and ‘acute asthma’ are used differently by patients and clinicians, and in different contexts. The classification of flare-ups and the classification of acute asthma overlap (e.g. a flare-up is considered to be at least ‘moderate’ if it is troublesome enough to cause the patient or carers to visit an emergency department or seek urgent treatment from primary care, yet it might be described as ‘mild’ acute asthma within acute services).

Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CXR</td>
<td>Chest X-Ray</td>
</tr>
<tr>
<td>ED</td>
<td>Emergency Department</td>
</tr>
<tr>
<td>HDU</td>
<td>High Dependency Unit</td>
</tr>
<tr>
<td>ICS</td>
<td>Inhaled Corticosteroid</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>LABA</td>
<td>Long Acting Beta Agonist</td>
</tr>
<tr>
<td>MDI</td>
<td>Metered Dose Inhaler</td>
</tr>
<tr>
<td>MET</td>
<td>Medical Emergency Team</td>
</tr>
<tr>
<td>PFT</td>
<td>Pulmonary Function Tests</td>
</tr>
<tr>
<td>NAC</td>
<td>National Asthma Council</td>
</tr>
<tr>
<td>PICU</td>
<td>Paediatric Intensive Care Unit</td>
</tr>
<tr>
<td>SAAS</td>
<td>South Australian Ambulance Service</td>
</tr>
<tr>
<td>SABA</td>
<td>Short Acting Beta Agonists</td>
</tr>
<tr>
<td>SPT</td>
<td>Skin Prick Test</td>
</tr>
<tr>
<td>WCH</td>
<td>Women’s and Children’s Hospital</td>
</tr>
</tbody>
</table>
Introduction

Asthma is one of the most common conditions in childhood. At any point in time 1 in 9 Australian children will have the diagnosis.

> It is one of the most common causes for presentation to primary care, emergency departments and for admission to hospital.
> Asthma exacerbations (flare ups) are often precipitated by viral infection.
> The diagnosis of asthma is usually clinical and should be considered in a child with cough, wheeze or difficulty breathing but may be aided by response to bronchodilators, past medical history and pulmonary function tests.
> Children who present with an acute episode of asthma may have had recurrent or persistent symptoms for some time. An acute presentation provides an opportunity to review long term management and any problems should be identified and arrangements made for continuing care.

Exclusions

Most children should be managed according to this guideline. The following children may need to be managed differently:

> Patients admitted to PICU / HDU with life-threatening asthma.
> Patients who have underlying medical conditions which may affect their respiratory status (e.g. other respiratory disease, heart disease, neuromuscular disorders).
> Infants under 1 year of age.

Assessment

History

Where appropriate and possible, a pre-printed template for asthma assessments should be used. The following areas should be covered unless previously recorded:

> Acute presenting history
  - Duration and nature of symptoms
  - Trigger/s (including upper respiratory tract infections, exercise, thunderstorm asthma). NB. Sudden onset of symptoms after insect sting or ingestion of food/medication may suggest anaphylaxis / not just asthma.
  - Treatment already given and response (dose, number of doses, time of last reliever dose).
  - Parental understanding of the treatment of acute episodes.

> Past asthma history
  - When diagnosed
  - Previous admissions including to PICU, number of ED presentations/ GP visits
  - Known triggers.
  - Interval symptoms – assess past Asthma control. See Appendix 2
  - Smoking exposure – home environment
  - Medicine and device history including current and past treatment
  - Adherence to preventer medicines
  - Other atopic conditions including food allergies, anaphylaxis and or allergic rhinitis
  - Past diagnostic tests – CXR, PFTs, SPT, bloods.
If previously diagnosed:
- Who currently manages the child’s asthma
- Dates of last review and next planned review

> Standard history as per any other patient
- Past medical history
- Family history
- Immunisations
- Medications
- Allergies
- Psychosocial history
- Developmental history

**Examination**

Key points to be noted include:

Degree of respiratory distress (see primary and secondary assessment table)
- Airway patency (ie. audible wheeze / stridor)
- Respiratory rate - compare to age-appropriate normal ranges
- Work of Breathing - use of accessory muscles and recession
- Auscultation – to assess breath sounds / air entry
- Ability to talk in phrases, sentences or words
- Posture or position
- Colour / Circulation
- Ability to tolerate food and fluids
- Oxygen saturation

> Mental state (alertness and responsiveness)
> Heart rate - compare to age-appropriate normal ranges (see Appendix 1). Remember that β2-agonists (Salbutamol, Terbutaline, and Eformoterol) will increase the heart rate.

**Additional information**

Peak flow has little use in acute asthma. Clinical assessment is the best indicator of severity.

**Assessing response to treatment**

Reassess response to bronchodilators after each dose. Check with auscultation assessment of chest prior to administration of salbutamol and then if possible 5 minutes afterwards. Continue to check response throughout treatment.

**Consider alternative diagnosis**

> The presence of wheeze does not necessarily mean a child has asthma or will develop asthma.
> Wheezing in infants less than 12 months is most commonly due to viral bronchiolitis and or airway malacia.
> Wheezing in children aged 1-5 years is usually associated with viral upper respiratory tract infections.
Investigations

Generally, no investigations are required in assessing acute asthma; however these tests below may be indicated for further clarification of presentation.

- **Chest x-ray** – Not routinely required. Consider in patients presenting with first episode of wheeze, particularly if doubt about diagnosis. Children with known asthma do not require a CXR unless there is a suspicion of pneumothorax, foreign body aspiration or major collapse/consolidation. Some degree of asymmetry of signs is common.

- **Blood tests (including blood gases)** – not routinely required. Electrolyte monitoring may be required for severe episodes or those concerned with Salbutamol toxicity.

- **Nasopharyngeal aspirate for respiratory viruses** – may be taken where identifying viral pathogen (e.g. illness not classical of asthma) or for cohorting / infection control purposes.

- **Pulmonary Function Tests (also known as Spirometry)**
  - **NB:** Patients with moderate - severe acute asthma should not perform spirometry.
  - Children aged 6 and older may be able to perform spirometry reliably.
  - Spirometry can be performed in primary care and or at an accredited respiratory function laboratory. It is important that reliable equipment and appropriately trained staff are available.
  - If a diagnosis of asthma is uncertain or the degree of medication responsiveness is questionable a pre- and post-bronchodilator response using Spirometry could be indicated in the acute setting.
  - Spirometry may be arranged in a hospital setting to check degree of obstruction and treatment response prior to discharge (if the child is able to perform reproducible results).
  - Alternatively, a referral for a spirometry test in an outpatient setting might be recommended once the child has recovered from their acute flare up.
Management

Assessment for acute asthma

Primary severity assessment


<table>
<thead>
<tr>
<th>Mild/Moderate</th>
<th>Severe</th>
<th>Life-threatening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can walk, speak whole sentences in one breath</td>
<td>Any of these findings:</td>
<td>Any of these findings:</td>
</tr>
<tr>
<td>(For young children: can move around, speak in phrases)</td>
<td>1. Use of accessory muscles of neck or intercostal muscles or 'tracheal tug' during inspiration or subcostal recession ('abdominal breathing')</td>
<td>1. Reduced consciousness or collapse</td>
</tr>
<tr>
<td>Oxygen saturation &gt;94%</td>
<td>2. Unable to complete sentences in one breath due to dyspnoea</td>
<td>2. Exhaustion</td>
</tr>
<tr>
<td></td>
<td>3. Obvious respiratory distress</td>
<td>3. Cyanosis</td>
</tr>
<tr>
<td></td>
<td>4. Oxygen saturation 90–94%</td>
<td>4. Oxygen saturation &lt;90%</td>
</tr>
</tbody>
</table>

Notes:
The severity category may change when more information is available (e.g. pulse oximetry, spirometry) or over time.
The presence of pulsus paradoxus (systolic paradox) is not a reliable indicator of the severity of acute asthma.
If oxygen therapy has already been started, it is not necessary to cease oxygen to measure pulse oximetry.
Oxygen saturation levels are a guide only and are not definitive; clinical judgment should be applied.
Definitions of severity classes for acute asthma used may differ from those used in published clinical trials, those based on severity of flare ups as well as other guidelines that focus on, are or restricted to, the management of acute asthma within emergency departments or acute care facilities.
A patient is usually recommended to seek a hospital / acute care facility if needing a reliever more frequently than 3 hourly and or has the above worsening symptoms.
### Secondary severity assessment


**Table - Secondary severity assessment of acute asthma in children aged 1-5 years**

*Note*: If features of more than one severity category are present, record the higher category as overall severity level.

<table>
<thead>
<tr>
<th></th>
<th>Mild/Moderate (all of)</th>
<th>Severe (any of)</th>
<th>Life-threatening (any of)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consciousness</strong></td>
<td>Alert</td>
<td>†</td>
<td>Drowsy or unconscious</td>
</tr>
<tr>
<td><strong>Speech</strong></td>
<td>Can talk or vocalise</td>
<td>†</td>
<td>Unable to vocalise due to dyspnoea</td>
</tr>
<tr>
<td><strong>Posture</strong></td>
<td>Can walk or crawl</td>
<td>Lethargic</td>
<td>Collapsed or exhausted</td>
</tr>
<tr>
<td><strong>Breathing</strong></td>
<td>Respiratory distress is not severe</td>
<td>Paradoxical chest wall movement: inward movement on inspiration and outward movement on expiration (chest sucks in when person breathes in) or Use of accessory muscles of neck or intercostal muscles or ‘tracheal tug’ during inspiration or Subcostal recession (‘abdominal breathing’)</td>
<td>Severe respiratory distress or Poor respiratory effort</td>
</tr>
<tr>
<td><strong>Skin colour</strong></td>
<td>Normal</td>
<td>†</td>
<td>Cyanosis</td>
</tr>
<tr>
<td><strong>Respiratory rate</strong></td>
<td>Normal</td>
<td>Tachypnoea</td>
<td><strong>Bradypnoea</strong> (indicates respiratory exhaustion)</td>
</tr>
<tr>
<td><strong>Heart rate</strong></td>
<td>Normal</td>
<td>Tachycardia</td>
<td><strong>Cardiac arrhythmia</strong> or <strong>Bradycardia</strong> (may occur just before respiratory arrest)</td>
</tr>
<tr>
<td><strong>Chest auscultation</strong></td>
<td>Wheeze or Normal lung sounds</td>
<td>†</td>
<td>Silent chest or Reduced air entry</td>
</tr>
<tr>
<td><strong>Oxygen saturation (pulse oximetry)</strong></td>
<td>&gt;94%</td>
<td>90–94%</td>
<td>&lt;90% or Clinical cyanosis</td>
</tr>
</tbody>
</table>

† Not applicable – may be the same as moderate and does not determine severity category.
### Table - Secondary severity assessment of acute asthma in children 6 years and over

**Note:** If features of more than one severity category are present, record the higher (worse) category as overall severity level.

<table>
<thead>
<tr>
<th></th>
<th>Mild/Moderate (all of)</th>
<th>Severe (any of)</th>
<th>Life-threatening (any of)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consciousness</strong></td>
<td>Alert</td>
<td>†</td>
<td>Drowsy or unconscious</td>
</tr>
<tr>
<td><strong>Speech</strong></td>
<td>Can finish a sentence in one breath</td>
<td>Can only speak a few words in one breath</td>
<td>Can’t speak</td>
</tr>
<tr>
<td><strong>Posture</strong></td>
<td>Can walk</td>
<td>Unable to lie flat due to dyspnoea</td>
<td>Collapsed or exhausted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sitting hunched forward</td>
<td></td>
</tr>
<tr>
<td><strong>Breathing</strong></td>
<td>Respiratory distress is not severe</td>
<td>Paradoxical chest wall movement: inward movement on inspiration and outward movement on expiration (chest sucks in when person breathes in) or Use of accessory muscles of neck or intercostal muscles or ‘tracheal tug’ during inspiration or Subcostal recession (‘abdominal breathing’)</td>
<td>Severe respiratory distress or Poor respiratory effort</td>
</tr>
<tr>
<td><strong>Skin colour</strong></td>
<td>Normal</td>
<td>†</td>
<td>Cyanosis</td>
</tr>
<tr>
<td><strong>Respiratory rate</strong></td>
<td>&lt;25 breaths/min</td>
<td>≥25 breaths/min</td>
<td>Bradypnoea (indicates respiratory exhaustion)</td>
</tr>
<tr>
<td><strong>Heart rate</strong></td>
<td>Children: normal range</td>
<td>Children: tachycardia</td>
<td>Cardiac arrhythmia or Bradycardia (may occur just before respiratory arrest)</td>
</tr>
<tr>
<td><strong>Chest auscultation</strong></td>
<td>Wheeze or Normal lung sounds</td>
<td>†</td>
<td>Silent chest or Reduced air entry</td>
</tr>
<tr>
<td><strong>Oxygen saturation (pulse oximetry)</strong></td>
<td>&gt;94%</td>
<td>90–94%</td>
<td>&lt;90% or Clinical cyanosis</td>
</tr>
<tr>
<td><strong>Blood gas analysis (adults, if performed)</strong></td>
<td>Not indicated</td>
<td>Not indicated</td>
<td>$\text{PaCO}_2 &lt; 60 \text{ mmHg}$ \text{PaCO}_2 &gt;50 \text{ mmHg}$§ \text{PaCO}_2$ within normal range despite low $\text{PaO}_2$ \text{pH} &lt;7.35$#</td>
</tr>
<tr>
<td><strong>FEV</strong></td>
<td>&gt; 50% predicted or personal best</td>
<td>&gt; 50% predicted or personal best</td>
<td></td>
</tr>
</tbody>
</table>

† Not applicable – may be the same as moderate and does not determine severity category
‡ Perform blood gas analysis only if clinically indicated
§ The presence of hypercapnoea indicates that the patient is tiring and may need ventilatory support.
# Metabolic acidosis (often associated with hypokalaemia) may occur with increased work of breathing and with high-dose salbutamol.
Medication Doses and Add on Treatments

* Refer to individual prescribing guidelines in your area for each administration

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose Options</th>
</tr>
</thead>
</table>
| **Hydrocortisone (IV)** | **Option 1:** hydrocortisone IV 4 mg/kg (maximum 100 mg) every 6 hours on day 1 then reduce (every 12 hours on day 2, once daily on day 3 and, if needed, once daily on days 4–5) or switch to oral prednisolone.  
**Option 2:** methylprednisolone IV 1 mg/kg (maximum 60 mg) every 6 hours on day 1 then reduce (every 12 hours on day 2, once daily on day 3 and, if needed, once daily on days 4–5) or switch to oral prednisolone. |
| **Ipratropium bromide (Inhaled)** | 1-5 years: 4 puffs via MDI (21microgram/puff) or 250microgram nebulised.  
≥6 years: 8 puffs via MDI (21microgram/puff) or 500microgram nebulised.  
**Note:** Ipratropium bromide dries out secretions and may worsen mucous plugging by virtue of increased tenacity of airway mucus. |
| **Magnesium Sulphate (IV)** | Children 2 years and over - 0.1- 0.2 mmol/kg/dose (maximum dose 10 mmol).  
IV infusion over 20 minutes.  IV MgS04 may be associated with hypotension.  
IV Aminophylline, magnesium and salbutamol must be given via separate IV lines. |
| **Aminophylline** | **Severe acute asthma**  
Adjust maintenance dose according to plasma theophylline concentration.  
Local protocols may differ from the doses below.  
**Loading**  
If child is already on theophylline, check plasma concentration first; if unable to do so, omit loading dose.  
A dose of 0.6 mg/kg aminophylline is expected to raise plasma theophylline concentration by 1 microgram/ml (5.5 micromol/L).  
1-12 months: IV 5mg/kg.  
1-18 years: IV 5-10 mg/kg (maximum 500mg). Younger children are more likely to require doses at the upper end of the range due to increased clearance. |
Aminophylline
(Third-line bronchodilator in life-threatening acute asthma that has not responded to continuous nebulised salbutamol after considering other add-on treatment options)

<table>
<thead>
<tr>
<th>Maintenance: continuous IV infusion PICU only</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 weeks - 6 months</td>
</tr>
<tr>
<td>6 – 12 months</td>
</tr>
<tr>
<td>1 – 9 years</td>
</tr>
<tr>
<td>9 – 12 years</td>
</tr>
<tr>
<td>12-18 years</td>
</tr>
</tbody>
</table>

Prednisolone (Oral)
For children aged 6-11 years with acute asthma (and children aged 1–5 if acute wheezing is severe), start systemic corticosteroids within 1 hour of presentation (unless contraindicated).

Give prednisolone 1 mg/kg (maximum 50 mg) orally each morning for 3 days.

It is usually not necessary to taper the dose unless the duration of treatment exceeds 2 weeks.

Note: A longer course (e.g. 5 days) may be needed for severe cases.

• For children aged 1-5 years, systemic corticosteroids should generally be limited to those with severe acute wheezing to avoid over-use (particularly for those with intermittent viral-induced wheezing).

Salbutamol (Inhaled)
NB. The use of a MDI with a spacer is the recommended administration route in acute asthma

Do not prescribe oral salbutamol. Inhalation is the recommended route for delivering relievers for all children and adults.

| < 6 years | 6 puffs (600 microgram) via spacer or 2.5mg nebulised |
| ≥ 6 years | -12 puffs (1200 microgram) via spacer or 5mg nebulised |

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

Ensure patient sitting upright.

> Use a salbutamol pressurised metered-dose inhaler (100mcg/actuation) with a spacer.

> Place mouthpiece between the person’s teeth and ask them to seal lips firmly around mouthpiece.*

> Fire one puff into the spacer.

> Ensure the child takes 4 ‘normal tidal breaths’ in and out of the spacer.

> 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.)

*For small children (< 4 years of age) who cannot form a tight seal with their lips around the spacer mouthpiece, attach a well-fitted mask to the spacer.

Please be aware that different dosages of Salbutamol are recommended for patients and carers giving asthma first aid in the community.

For example Asthma First Aid 4x4x4 (See Appendix 5)
### Salbutamol nebulisation (Inhaled)

**NB:** The use of nebulisers increases the risk (to staff and patients) of nosocomial aerosol infection. If using a nebuliser, follow your organisation’s infection control protocols to minimise spread of respiratory tract infections.

<table>
<thead>
<tr>
<th><strong>Driving nebuliser</strong></th>
<th>Nebulisers can be driven by air, piped oxygen, or an oxygen cylinder fitted with a high-flow regulator capable of delivering &gt;6 L/min.</th>
</tr>
</thead>
</table>
| **Intermittent nebulisation** | Children 6 years and over: 5 mg nebule  
Children 0–5 years: 2.5 mg nebule |
| **Continuous nebulisation using nebules** | Put two nebules into nebuliser chamber at a time and repeat to refill when used up.  
Children 6 years and over: use two 5 mg nebules (10 mg) at a time  
Children 0–5 years: use two 2.5 mg nebules (5 mg) at a time  
If using oxygen to drive a nebuliser, do not exceed 8–10 L/minute and avoid over-oxygenation (increases risk of hypercapnoea). |

### Salbutamol (IV)

Third line bronchodilator in life-threatening acute asthma that has not responded to continuous nebulised salbutamol after considering add on treatment options

**NB.** Only in ICU

| **Bolus:** | Children 2-12 Loading dose of 5microgram/kg/min (maximum 200 microgram/kg/min) for 1 hour, then 1-2microgram/kg/min (maximum 80microgram/minute)  
Children >12 as infusion loading dose 200 microgram over 1 minute then 5 microgram/minute (can increase to 10 microgram/minute, then up to 20 microgram/minute every 15-30 minutes according to response.  
As bolus 250 micrograms over 5 minutes  
*Refer to local guidelines for administration  
**Monitor for salbutamol toxicity** (e.g. Tachycardia, tachypnoea, metabolic acidosis, hypokalaemia) – which may occur with frequent doses of inhaled or IV Salbutamol. |

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*INFORMAL COPY WHEN PRINTED*
Admission and discharge criteria

Discharge from Emergency Department or other acute care setting

> Patients may be discharged home if:
  - Tolerating 3 hours between bronchodilator doses or as per asthma discharge criteria as per individual Local Health network policies and procedures.
  - Normal oxygen saturations >94% and normal vital signs (appendix 1) (within age appropriate limits) in air.
  - Sensible carers and easy access to medical care in the event of an acute deterioration.

> Parent / Carer Asthma Education
  - All patients & families should have their level of asthma knowledge reviewed and appropriate education given upon every review.
  - Patients and families should go home with written education material including:
    - Asthma Action Plan (See Appendix 5 for variety of templates)
    - Recovery or Asthma Discharge Plan (See Appendix 3)
    - School and Childcare plans if needed (See Appendix 5)
  - It is the medical officer’s responsibility to ensure they discuss the weaning discharge plan and asthma action plan with the patients / care givers. (See Appendix 5 for variety of templates)
  - Advise GP review in 3 days and make a second appointment 3-4 weeks later as per National Asthma Council Asthma D/C plan – (see Appendix 3) severe asthma, consider specialist referral – see Appendix 4.
  - Advise parents to seek further medical attention should the child’s condition deteriorate or if there is no significant improvement within 48 hours. Parents should be educated on recognising signs of deterioration. (See Appendix 5 Asthma First Aid)

> Discharge medications
  - Salbutamol initially 3-4 hourly with a weaning plan over the next 3-4 days.
  - Continue oral Prednisolone to finish 3 days (no need for a weaning dose for courses less than 14 days).
  - Utilise pharmacists for medication education (if available).

> Inhaler device and spacer technique should be checked before discharge.

> Families with the below criteria can be referred to Asthma Australia for education – www.asthmaaustralia.referrals. Group education sessions can be arranged.
  - Newly diagnosed asthma (> 2 years)
  - Culturally & Linguistically Diverse Patients with English as a second language
  - Patients not linked in with regular GP support
  - Frequent hospital presentations with asthma

> Consider preventive treatment if there are frequent acute episodes or interval symptoms between acute episodes (more than one disturbed night per week, difficulty participating in physical activities or bronchodilator use on more than two days per week).

> Consider treating allergic rhinitis if also uncontrolled.
In children, consider admitting patient to hospital if (any of):

- hypoxia at presentation
- respiratory distress/increased work of breathing unresolved 1–2 hours after presentation
- a history of ICU admission for asthma
- presentation for acute asthma within the past 4 weeks
- frequent presentations for acute asthma (e.g. several over previous year)
- high recent use of beta₂ agonists
- patient cannot be monitored adequately at home or cannot easily return to hospital if needed
- confirmed food allergy
- other risk factors for adverse outcomes.

Consider admission to HDU/PICU/MedSTAR Kids retrieval

> Signs of critical asthma severity,
> requiring continuous nebulisers for >1 hour without improvement,
> requiring Salbutamol more frequently than every 30 minutes after 2 hours,
> hypoxia despite maximal oxygen or raised CO₂.

All patients admitted with life threatening asthma (severe enough to require PICU/ HDU admission) are recommended to have an inpatient Paediatric Respiratory Physician assessment and have intensive asthma education and care coordination.

Utilise Respiratory Nurse Consultant if available or accredited Asthma Nurse Educators.

Inpatient management

Review regularly as dictated by degree of severity.

Hypoxia may be the result of significant airway obstruction due to factors such as atelectasis and or mucous plugging of the airways. Slow weaning of oxygen and a longer course of steroids may be indicated in this patient group.

High Flow oxygen may also lead to drying of the upper airways leading to worsening broncho-constriction. The use of humidified oxygen might mitigate this.

Weaning Salbutamol

> Wean by extending time between doses by 30-60 mins aiming for 3 hours or greater between doses.
> A medical review is required if a patient deteriorates or requires more frequent Salbutamol than previously or if their oxygen requirement increases.
> The use of Salbutamol nebuliser is contraindicated if a patient requires Humidified High Flow Nasal Cannula oxygen (HHFNC).
Discharge from hospital

> Patients can be safely discharged if they are stable after two consecutive three hour periods between Salbutamol doses.

> Some Hospitals use a Criteria Led Discharge template.

**Medications upon discharge**

Discharge medications:

> Salbutamol usually 3-4 hourly with a weaning plan over the next 3-4 days.

> Continue oral Prednisolone to finish 3 days (no need for a weaning dose for courses less than 14 days).

> Preventer if required.

Preventive treatment should be commenced if there are interval symptoms between acute episodes (nocturnal symptoms, difficulty participating in physical activities, or bronchodilator use on more than two days per week). It should also be considered if there are frequent acute episodes.

If commencing preventive treatment emphasise the importance of ongoing review with General Practitioner / health professional; and arrange follow up if none is in place.

**Follow Up**

> Advise GP review in 3 days and make a second appointment 3-4 weeks later as per National Asthma Council Asthma D/C plan (see Appendix 3).

> Consider specialist referral for patients with severe or difficult to control asthma. (See Appendix 4).

> Patients with the following should also be considered for referral to an asthma educator or a community asthma nurse:
  - Newly diagnosed asthma
  - Poorly controlled asthma
  - Severe asthma e.g. requiring PICU
  - Adherence issues
  - Concerns regarding home management
  - Patients from a non-English speaking background

> Encourage SA Ambulance cover.

> Advise re smoking cessation and trigger avoidance as necessary

> Recommend annual flu vaccine for children with asthma and their parents /care givers in addition to routine immunisations.
## Information and Resources available

<table>
<thead>
<tr>
<th><strong>Asthma Australia</strong></th>
<th><strong>National Asthma Council Australia</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Asthma Assist - <strong>Free Call 1800 ASTHMA (1800 278 462)</strong> Monday – Friday 0900 – 1700</td>
<td>• <strong>Australian Asthma Handbook</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Managing Acute Asthma in Clinical Setting</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Asthma Action Plan Library</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Health Professional Education and Training</strong></td>
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<tr>
<th><strong>Lung Foundation Australia</strong></th>
<th><strong>QuitSA</strong></th>
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<th><strong>SA Ambulance</strong></th>
<th><strong>ASCIA</strong></th>
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<tr>
<th><strong>Companion documents</strong></th>
<th><strong>Department for Education and Child Development</strong></th>
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<tbody>
<tr>
<td><strong>Healthcare forms</strong>, including asthma specific forms and medication authority. Medical Director compatible forms can be downloaded.</td>
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</table>
References

The South Australian statewide guideline on the management of acute asthma is based on the British Thoracic Society & Scottish Intercollegiate Guidelines Network, British Guideline on the Management of Asthma, Revised June 2009.

No additional literature searches were conducted.

Other guidelines reviewed:
- National Asthma Council of Australia – Australian Asthma Handbook Version 2.0 accessed online
- NSW Asthma Guideline - NSW Department of Health 2004
- Starship Paediatric Health Clinical Practice Guidelines - Management of acute asthma and Management of life-threatening asthma (content reproduced with the permission of Dr Raewyn Gavin)
- Royal Children's Hospital guideline - Asthma (Acute) Guideline (past draft content reproduced with the permission of Dr Mike South)

Other information sources:
- Asthma Australia. State of Asthma in South Australia, September 2018
- Royal Children's Hospital Paediatric Pharmacopoeia 13th Edition - accessed online
- Rowe BH, Bretzlaff J, Bourdon C, Bota G, Blitz S, Camargo CA. Magnesium sulfate for treating exacerbations of acute asthma in the emergency department. Cochrane Database of Systematic Reviews 2000, Issue 1
- Sunit Singhi, Joseph L. Mathew and Paul Torzillo What is the role of subcutaneous adrenaline in the management of acute asthma? International Child Health Review Collaboration
- Women's and Children's Hospital IV Salbutamol guidelines – WCH Pharmacy Dept 12/6/09
- British National Formulary for Children - 2010-2011
Acknowledgements

The South Australian Child and Adolescent Health Community of Practice gratefully acknowledge the contribution of clinicians and other stakeholders who participated throughout the guideline development process particularly:

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Write Group Members
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Sheridan Alexander

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Asthma Australia Health Services Team

SA Paediatric Clinical Practice Guideline Reference Group Members

Document Ownership & History

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If so, which version? V2
Does this policy replace another policy with a different title? Y
If so, which policy (title)? Management of Acute Asthma in Children

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<th>Version</th>
<th>Who approved New/Revised Version</th>
<th>Reason for Change</th>
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<td>15/08/19</td>
<td>V3</td>
<td>SA Health Safety &amp; Quality Strategic Governance Committee</td>
<td>Formally reviewed in line with 1-5 year scheduled timeline for review.</td>
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<td>SA Health Safety &amp; Quality Strategic Governance Committee</td>
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<td>24/01/12</td>
<td>V1</td>
<td>SA Health Safety &amp; Quality Strategic Governance Committee</td>
<td>Original approved version</td>
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Appendices

APPENDIX 1 – Paediatric Normal Ranges

Normal respiratory and heart rates in children

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Heart rate (beats/minute)</th>
<th>Respiratory rate (breaths/minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 year</td>
<td>110-160</td>
<td>30-40</td>
</tr>
<tr>
<td>1-2 years</td>
<td>100-150</td>
<td>25-35</td>
</tr>
<tr>
<td>2-5 years</td>
<td>95-140</td>
<td>25-30</td>
</tr>
<tr>
<td>5-12 years</td>
<td>80-120</td>
<td>20-25</td>
</tr>
<tr>
<td>12-18 years</td>
<td>60-100</td>
<td>15-20</td>
</tr>
</tbody>
</table>

### APPENDIX 2 – Definition of Levels of Recent Asthma Symptom Control in Children (Regardless of Current Treatment Regime)


<table>
<thead>
<tr>
<th>Good control</th>
<th>Partial control</th>
<th>Poor control</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of:</td>
<td>Any of:</td>
<td>Either of:</td>
</tr>
<tr>
<td>• Daytime symptoms(^1) ≤ 2 days per week (lasting only a few minutes and rapidly relieved by rapid-acting bronchodilator)</td>
<td>• Daytime symptoms(^1) &gt; 2 days per week (lasting only a few minutes and rapidly relieved by rapid-acting bronchodilator)</td>
<td>• Daytime symptoms(^1) &gt; 2 days per week (lasting from minutes to hours or recurring, and partially or fully relieved by SABA reliever)</td>
</tr>
<tr>
<td>• No limitation of activities(^2)</td>
<td>• Any limitation of activities(^2)</td>
<td>• ≥ 3 features of partial control within the same week</td>
</tr>
<tr>
<td>• No symptoms(^3) during night or when wakes up</td>
<td>• Any symptoms during night or when wakes up(^\dagger)</td>
<td></td>
</tr>
<tr>
<td>• Need for SABA reliever(^4) ≤ 2 days per week</td>
<td>• Need for SABA reliever(^4) &gt; 2 days per week</td>
<td></td>
</tr>
</tbody>
</table>

**SABA:** short-acting beta\(_2\) agonist

\(^1\) e.g., wheezing or breathing problems

\(^2\) child is fully active: runs and plays without symptoms

\(^3\) including no coughing during sleep

\(^4\) not including doses taken prophylactically before exercise. (Record this separately and take into account when assessing management.)

\(^5\) e.g., wheeze or breathlessness during exercise, vigorous play or laughing

\(^\dagger\) e.g., waking with symptoms of wheezing or breathing problems

**Notes:**

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

Validated questionnaires can be used for assessing recent symptom control:

- Test for Respiratory and Asthma Control in Kids (TRACK) for children < 5 years
- Childhood Asthma Control Test (C-ACT) for children aged 4–11 years

Last reviewed version 2.0
APPENDIX 3 - Acute Asthma Discharge Plan for Children

Asthma discharge plan

Going home after a severe asthma attack

For children aged 1–11 years

This asthma discharge plan was prepared on: ___ day ___ month ___ year 20___

You have been given this plan because your child has been treated for asthma in the emergency department or hospital.

This plan explains what to do until you visit your usual doctor for an asthma check-up.

You will be given inhalers and medicines for your child to take and you will be shown how to use them.

Important safety information

Follow these instructions carefully.

If your child uses a preventer every day (inhaler or tablets), keep using it as well as taking any new medicines we give you.

Your medicines

<table>
<thead>
<tr>
<th>[Strike out any that do not apply]</th>
<th>Name of medicine [Write brand name and strength, if known]</th>
<th>When and how to take it [Strike out instructions that do not apply]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliever (salbutamol)</td>
<td>[space for free text]</td>
<td>Use the reliever inhaler when the child has asthma symptoms (breathing problems or a tight feeling in the chest). Take 2 puffs (1 puff at a time), using a spacer. If the child needs to use the reliever again within 4 hours, see your GP or go to the emergency department.</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>[space for free text]</td>
<td>Take ___ tablets every morning with food for ___ days. Take ___ mL every morning with food for ___ days. [space for free text]</td>
</tr>
<tr>
<td>Preventer</td>
<td>[space for free text]</td>
<td>Take ___ puffs ___ times each day [space for free text]</td>
</tr>
<tr>
<td>Other</td>
<td>[space for free text]</td>
<td>[space for free text]</td>
</tr>
<tr>
<td>Other</td>
<td>[space for free text]</td>
<td>[space for free text]</td>
</tr>
</tbody>
</table>

Draft: 5 December
APPENDIX 4 – Public Paediatric Specialist Referral Centres

> Women’s and Children’s Hospital - General Medicine and Respiratory outpatients
> Flinders Medical Centre - General Medicine outpatients
> Modbury Hospital
> Mt Gambier Hospital
> Pt Augusta Hospital

There are many private paediatricians in Adelaide and Regional Centre’s.

Emergency Services

> MedSTAR Kids – South Australian emergency retrieval and advice service. Call 13STAR (137827) 24 hours per day

APPENDIX 5 – Action Plan and Asthma First Aid

> Provide and explain Asthma Action Plan
  > Department for Education Health Care Plans
  > National Asthma Council Asthma Action Plan Library
  > National Asthma Council Translated Asthma Action Plans (other languages)

> Provide and explain Discharge plan or Recovery Plan (ensuring the parent/care giver knows the medication management plan post discharge)

> Discharge summary (generally sent through to the patients’ lead General Practitioner)

> Spacer equipment and / or mask (supplied by the hospital, purchased from Home Equipment Centre or at a local pharmacy)
  > Check puffer and spacer technique is correct.
  > Utilise medication videos as teaching tools to assess device technique
  > Promote and encourage preventer adherence