Pre-school wheeze – Emergency management in children

Purpose

This document provides clinical guidance for all staff involved in the care and management of children aged 1 to 5 years presenting to an Emergency Department (ED) in Queensland with a wheezing illness.

This guideline has been developed by senior ED clinicians and Paediatricians across Queensland, with specialist input from Paediatric Respiratory staff, Lady Cilento Children's Hospital, Brisbane. It has been endorsed for use across Queensland by the Statewide Emergency Care of Children Working Group in partnership with the Queensland Emergency Department Strategic Advisory Panel and the Healthcare Improvement Unit, Clinical Excellence Division.

Guidance for wheezing children aged less than 1 year can be found in the Australasian Bronchiolitis Guideline. For wheezing children over 5 years refer to the Asthma- Emergency management in children Guideline.

Key points

- Wheezing in pre-school-aged-children is due to a heterogeneous group of diseases.
- A thorough assessment and continuous review is necessary for each child during their presentation.
- Steroids are not indicated in pre-school children who present for the first time or infrequently with a mild-moderate wheeze.
- Wheezing illnesses can be life-threatening. Seek senior emergency/paediatric advice promptly for a child with severe respiratory distress or who is not responding to therapy.

Introduction

Wheeze is a very common ED presentation in children that is usually caused by intercurrent viral infection or other environmental triggers.

Definition

Wheeze is a continuous high-pitched sound with musical quality emitting from the chest during expiration,\(^1\) with increased work of breathing.\(^2\) Pre-school wheeze is also referred to as reactive airways disease.

Epidemiology

Evidence suggests that up to 30% of children will have at least 1 episode of wheezing prior to their 3rd birthday,\(^3,4\) over half will have >1 episode\(^5\) and 60% will stop wheezing by 6 years of age.

Classification

The pathology and natural progression of wheezing illnesses in pre-schoolers is variable and not fully understood. The clinical definitions for the temporal pattern of pre-school wheeze that have been proposed by the 2008 European Respiratory Task Force (ERS)\(^1\) to guide treatment are outlined in the table below.
### Clinical definitions of wheeze

<table>
<thead>
<tr>
<th>Wheeze type</th>
<th>Definition</th>
<th>Epidemiology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Episodic viral wheeze</strong></td>
<td>Wheeze during discrete time periods, often in association with clinical evidence of a viral infection, with absence of wheeze between episodes</td>
<td>Most common in preschool children. Usually associated with a viral respiratory tract infection e.g. rhinovirus, RSV, coronavirus, human metapneumovirus, parainfluenza virus and adenovirus. Repeated episodes tend to occur seasonally. Usually declines over time disappearing by 6 years but can continue to school age and change into MTW or disappear.</td>
</tr>
</tbody>
</table>
| **Multi-trigger wheeze**     | Wheezing that shows discrete exacerbations but also symptoms between episodes | Triggers include:  
• viral infection (most common)  
• tobacco smoke  
• allergen exposure  
• mist  
• crying  
• laughter  
• exercise |

Though it is thought that MTW reflects chronic allergic airway inflammation there is little evidence to support this. Pre-school wheeze should be described in terms of the temporal patterns (EVW and MTW), frequency, severity, age of onset and relevant associated clinical parameters such as atopy and eczema. Note that children may change between categories over time and in that event pharmacological treatment should also change.

### Asthma

The term asthma is not used to describe pre-school wheezing illness as there is insufficient evidence that the pathophysiology of pre-school wheezing illness is similar to that of asthma in older children and adults.

Risk factors for a future diagnosis of asthma include:
- onset of wheezing over the age of 18 months
- personal history of atopy e.g. eczema
- maternal asthma

Several clinical predictive indices for future risk of asthma have been developed based on combinations of the presence of atopic manifestations, indirect evidence of airway inflammation such as peripheral blood eosinophil count, and severity of pre-school wheeze. The clinical utility of such predictive indices is limited due to a poor ability to correctly identify those who will develop asthma (positive predictive value (PPV) ranging from 44 to 54%). However, the absence of known risk factors can be useful to reassure parents of a lower risk of future asthma.

### Assessment

The purpose of assessment (history taking and physical examination) is to:
- confirm a wheezing disorder
- identify symptom pattern, severity and possible trigger factors
- look for features suggestive of an alternative diagnosis or associated condition

Studies have shown while physicians can accurately identify wheeze, parents may not be able to do so. Ideally, the presence of a wheeze should be confirmed by a clinician.
History

History should include specific information on:

- the wheeze, other noises and other signs (including respiratory distress)
- family history (including mother and sibling/s) of asthma and atopy
- smoking status of household members

All health professionals have a role in advocating for their patients by advising parents about the increased risk of wheezing associated with parental smoking.

Examination

The child should be assessed within the time frame recommended by the triage category. The child’s general appearance, mental state and level of respiratory distress are the most important markers of severity.7

**ALERT** – Wheeze may be absent in severe cases due to severe airway obstruction or extreme fatigue. A “silent chest” (chest with little or no breath sounds) is a warning sign of life-threatening respiratory failure and/or respiratory arrest.

Seek senior emergency/paediatric assistance as per local escalation protocols for a child with life-threatening wheeze. Consider seeking paediatric critical care advice.

### Initial rapid severity assessment: to be completed immediately

<table>
<thead>
<tr>
<th>Mild-moderate</th>
<th>Severe</th>
<th>Life-threatening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can walk or move around</td>
<td>Unable to complete sentences in one breath due to dyspnoea</td>
<td>Altered conscious level/exhaustion</td>
</tr>
<tr>
<td>Speak in phrases</td>
<td>SpO2 &lt; 90% in RA</td>
<td>Poor respiratory effort/agonal breathing</td>
</tr>
<tr>
<td>SpO2* &gt; 90% in room air (RA)</td>
<td>Significant respiratory distress +/- grunting</td>
<td>SpO2 &lt; 90% in RA +/- cyanosis</td>
</tr>
<tr>
<td>Mild respiratory distress#</td>
<td></td>
<td>Soft or absent breath sounds</td>
</tr>
</tbody>
</table>

*Oxygen saturations using pulse oximetry (commonly referred to as “sats”.) #Signs of respiratory distress include accessory muscle use, abdominal breathing, intercostal recession, subcostal recession and tracheal tug

### Secondary severity assessment: to be completed concurrently with initial bronchodilator dose

<table>
<thead>
<tr>
<th>Mild-moderate</th>
<th>Severe</th>
<th>Life-threatening</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL the following:</td>
<td>ANY of the following:</td>
<td>ANY of the following:</td>
</tr>
<tr>
<td>Alert</td>
<td>Agitated, restless, distressed</td>
<td>Drowsy or unconscious</td>
</tr>
<tr>
<td>Can talk or vocalise</td>
<td>Speech may be limited</td>
<td>Unable to vocalise due to dyspnoea</td>
</tr>
<tr>
<td>Can walk or crawl</td>
<td>Lethargic</td>
<td>Collapsed or exhausted</td>
</tr>
<tr>
<td>Mild-moderate respiratory distress</td>
<td>Severe respiratory distress</td>
<td>Severe respiratory distress or poor respiratory effort</td>
</tr>
<tr>
<td>Normal skin colour</td>
<td>Not applicable [NB2]</td>
<td>Cyanosis</td>
</tr>
<tr>
<td>Normal respiratory rate [NB3]</td>
<td>Tachypnoea</td>
<td>Bradypnoea [NB3]</td>
</tr>
<tr>
<td>Normal heart rate [NB4]</td>
<td>Tachycardia [NB4]</td>
<td>Cardiac arrhythmia or bradycardia (preterminal sign, may occur just before respiratory arrest)</td>
</tr>
<tr>
<td>Wheeze or normal lung sounds</td>
<td>Not applicable [NB2]</td>
<td>‘Silent chest’ or reduced air entry</td>
</tr>
<tr>
<td>SpO2 &gt; 90%</td>
<td>SpO2 &gt; 90%</td>
<td>SpO2 &lt; 90% or clinical cyanosis</td>
</tr>
</tbody>
</table>

**NB2**: May be the same as mild–moderate and does not determine severity level.

**NB3**: Normal respiratory rate (breaths/min): younger than 1 year, 30 to 40; 1 to 2 years, 25 to 35; 2 to 5 years, 25 to 30.

**NB4**: Normal heart rate (beats/min): younger than 1 year, 110 to 160; 1 to 2 years, 100 to 150; 2 to 5 years, 95 to 140.

Source: Adapted from Therapeutic Guidelines and Asthma Handbook
Oxygen Monitoring

Oxygenation (Sp02) is effectively measured in using pulse oximetry. Poor gas exchange and decreased saturations may be a result of severe airway obstruction due to bronchoconstriction, airway oedema and/or mucous plugging.8

Differential Diagnosis

Wheeze is due to narrowing of intrathoracic airways and expiratory flow, irrespective of the underlying mechanism. However, there are alternative and less common reasons for a child to wheeze. Consider further investigation if assessment (history and examination) identifies as any unusual features which may allude to the differential diagnoses outlined in the following table.

<table>
<thead>
<tr>
<th>Less common causes of wheeze in children</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respiratory</strong></td>
</tr>
<tr>
<td>Anatomical abnormalities of the airway. e.g. tracheomalacia, bronchomalacia</td>
</tr>
<tr>
<td>Chronic supplicative lung disease/bronchiectasis including cystic fibrosis</td>
</tr>
<tr>
<td>Bronchiolitis obliterans</td>
</tr>
<tr>
<td><strong>Other</strong></td>
</tr>
<tr>
<td>Inhaled foreign body</td>
</tr>
<tr>
<td>Cardiac failure</td>
</tr>
<tr>
<td>Gastro-oesophageal reflux</td>
</tr>
</tbody>
</table>

Investigations

No investigations are routinely recommended for a wheezing disorder diagnosis.2 Circumstances1 in which investigations are usually required include children with:

- severe symptoms
- unusual clinical presentation prompting diagnostic uncertainty including symptoms present from birth
- asymmetrical clinical signs that fail to resolve
  - atypical clinical course e.g. recovery is very slow or incomplete
  - episodes continue in the absence of a viral infection

<table>
<thead>
<tr>
<th>Investigations for the management of wheeze in pre-school children</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Investigation type</strong></td>
</tr>
<tr>
<td><strong>Utility</strong></td>
</tr>
<tr>
<td>Respiratory viral PCR</td>
</tr>
<tr>
<td>May be useful to reassure the family but not routinely recommended as does not alter the short or long-term management.</td>
</tr>
<tr>
<td>Chest X-Ray</td>
</tr>
<tr>
<td>No evidence to support use.1 Exceptions include a child with an atypical history or who does not respond to therapy to assess for alternative or additional causes of the presentation e.g. pneumonia or inhaled foreign body.</td>
</tr>
<tr>
<td>Blood tests</td>
</tr>
<tr>
<td>May be considered for children:</td>
</tr>
<tr>
<td>• with a severe/life-threatening episode</td>
</tr>
<tr>
<td>• not responding to therapy</td>
</tr>
<tr>
<td>• being considered for escalation including intravenous medications</td>
</tr>
<tr>
<td>• receiving treatment for contributing causes such as pneumonia.</td>
</tr>
<tr>
<td>A venous gas may be useful for venous carbon dioxide (CO2) and electrolyte monitoring (especially potassium).</td>
</tr>
</tbody>
</table>
Management

The management of pre-school wheeze comprises of medications targeted at relieving acute bronchospasm, alleviating lower airways inflammation, and providing respiratory support in the form of oxygen and non-invasive ventilation. Medications to treat wheeze when associated with mild respiratory distress may not be necessary e.g. steroids, inhaled ipratropium bromide. Refer to the Appendix 1 and 2 for a summary of the recommended emergency management and medications.

Reassessment

There is a spectrum of clinical presentations of wheeze in young children, and patients may transition from one phenotype to another or have a mixed picture. Repeated clinical assessment is recommended following each treatment to objectively determine the change in clinical symptoms (improvement/no change/deterioration). This should be well documented in the patient clinical notes. Medications should be discontinued if there is no objective change.

Acute management

Bronchodilators

A trial of short acting inhaled beta2 agonists (salbutamol, Ventolin) is recommended for all wheezing children between the ages of 12 months and 5 years. Continuous oximetry should be performed for children on salbutamol with a frequency < 2nd hourly. Bronchodilators may produce a paradoxical effect in children with underlying structural abnormalities such as bronchomalacia or tracheomalacia.

| Inhaled salbutamol dosing for the treatment of wheeze in pre-school children |
|-------------------------|------|----------------|------|
| **MDI** 100mcg | < 20 kg: 6 puffs | >20kg: 12 puffs |
| Nebulised | < 20 kg: 2.5mg | >20kg: 5mg |
| Salbutamol burst | Administer 3 doses as above at 20-minute intervals |
| Continuous nebulised salbutamol | Neat salbutamol nebuliser solution (5mg/mL), replenish where reservoir empty |

*Metered Dose Inhaler. Always use via spacer. Use mask also if unable to form a reliable seal on spacer

**ALERT** – Cumulative doses of salbutamol can cause agitation, tremor, tachycardia, tachypnoea and rarely, hypertension.
Raised lactate, hypokalaemia and raised glucose on VBG are markers of salbutamol toxicity.

MDI and spacer vs nebuliser

- Both modes of administration are equally effective for relieving bronchoconstriction.
- MDI is faster (nebulisation requires a child to sit still for at least 10 minutes).
- Delivery of salbutamol by nebuliser results in greater facial and oropharyngeal deposition of medication delivering at best 10% of the prescribed drug to the lungs, with consequent systemic absorption and side effects such as tachycardia and tremor.
- Children who are struggling with their breathing and not able to co-ordinate taking a deep breath through the spacer should be given nebulised medication.

How to use a spacer

- Prime spacer before use to negate electrostatic charge (and optimise drug delivery) with 10 salbutamol puffs.
- Shake MDI before each puff. Administer 1 puff at a time into the spacer (+/- face mask).
- The child clears the medication from the spacer by taking 5 breaths following each puff.
Weaning salbutamol

Stretching the time between salbutamol doses should be based on an assessment on the child. This should be done in collaboration with the child and caregiver\(^9\) and include:

- **respiratory distress**: decreased work of breathing (subcostal & intercostal recession/tracheal tug/nasal flaring)
- **activity level**: decreasing lethargy, increasing alertness
- **respiratory rate**: decreasing to within normal limits for age
- **heart rate**: decreasing to within normal limits for age. Note bronchodilator therapy increases heart rate.
- **speech**: able to talk in sentences
- **auscultation**: air entry improved, wheeze reduced or appearance of wheeze in previously quiet chest (note wheeze alone is not an indication for giving salbutamol)
- **cough**: reduction or change in cough i.e. becomes looser
- **oxygen saturations**: increasing oxygen saturations and decreasing oxygen requirement

### Inhaled anticholinergic agents

There is insufficient evidence to support the routine use of anti-cholinergic therapy (ipratropium bromide) for children with pre-school wheeze.\(^1\) However, the ready availability of MDIs often prompts the use of ipratropium, and therefore doses have been included for reference.

Children with severe symptoms should be considered for up to 3 doses of ipratropium bromide. This should be given following salbutamol MDI or in combination with salbutamol in nebuliser reservoir.\(^12\)

| Inhaled ipratropium dosing for the treatment of wheeze in pre-school children |
|-----------------------------|-------|---------|
| MDI * 20mcg                | < 20 kg: 4 puffs | >20kg: 8 puffs |
| Nebulised                  | < 20 kg: 250mcg | >20kg: 500mcg |
|                            | Maximum of 3 doses in 24 hours |

\(^*\)Metered Dose Inhaler. Always use via spacer. Use mask also if unable to form a reliable seal on spacer.

### Steroids

Steroids are not recommended for pre-school children who present for the first time or infrequently with mild to moderate wheeze, however the literature is constantly evolving. Some studies suggest that steroids do not reduce symptom severity or the need for hospital treatment in pre-school children with mild to moderate wheeze.\(^8\) A large randomised, double-blind, placebo-controlled trial found no significant difference in the duration of hospitalisation in children with mild to moderate wheezing associated with viral infection in those given oral steroids compared to placebo.\(^13\) However, a recent Australian study concluded that prednisone had a clear benefit at reduced length of stay in children with mild-moderate viral associated wheeze.\(^14\)

Steroids should still be used for pre-school children with wheeze who have:

- frequent episodes
- ongoing frequent bronchodilator use (<2 hourly)
- severe or life-threatening symptoms
- a requirement for intensive care unit admission

Consider steroids for pre-school children with a history suggestive of an asthma phenotype e.g. atopy and maternal family history of asthma.
Steroid dose

The systemic steroid of choice is oral prednisone/prednisolone. Studies have shown that an alternative steroid, dexamethasone, with benefits of a longer half-life, may also be a suitable treatment for children with wheeze. In a recent paediatric study, dexamethasone was found to have a similar efficacy as prednisone when comparing respiratory scores, with a single dose of 0.3mg/kg dexamethasone having the same efficacy as a course of prednisone to prednisone 0.1mg/kg for 3 days. However, dexamethasone suspension is not readily available in the community or non-tertiary hospitals.

| Prednisolone (PO) dosing for treatment of wheeze in pre-school children |
|-----------------|------------------|
| Day             | Dose             |
| Day 1           | 2mg/kg (max 50mg) |
| Day 2 and 3     | 1mg/kg |
| Can extend course to 5 days if still symptomatic after 3-day course |

Oxygen

Target oxygen saturations (SpO2) and the use of low and high flow oxygen therapy is highly variable depending upon local practice and resource availability.

The following section should be used as a guide, with local policies followed at all times.

There is no evidence to clearly define an optimal oxygen saturation (SpO2) target for young children with respiratory illnesses and therefore threshold for supplemental oxygen administration. Consensus opinion supports a target of SpO2 ≥ 94%. Lower saturations may be tolerated depending upon institutional practice. A study done in infants (<12 months of age) with bronchiolitis showed that a target SpO2 > 90% was as safe and clinically effective as 94%. This study may influence future consensus opinion in other respiratory tract illnesses in children. A current randomised controlled trial studying high flow oxygen therapy for children with acute hypoxemic respiratory failure uses a cut off of ≤ 92% for the commencement of oxygen supplementation.

Low flow oxygen should not be given to children for work of breathing in isolation, and the practice of “fly-by” oxygen (i.e. leaving a mask adjacent the patient’s face) is discouraged. Transient (< 5 mins) desaturations below the local limit during sleep with rapid self-correction does not mandate increasing or commencing supplemental oxygen. Nurse-initiated commencement of supplemental oxygen is suitable however, a review by a medical officer should be requested at the time for cause of deterioration and, where applicable (per institutional recommendations), should be prescribed on an oxygen order form.

Continuous oximetry should be performed in children requiring oxygen.

| Low flow oxygen for pre-school children with wheeze |
|-----------------|------------------|
| Flow rate*      | <2L/min | ≥ 4L/min |
| Method of delivery | Nasal prongs | Hudson mask |

*There is no role for 2-4L/min via mask.

Intravenous medications

Children with severe/life-threatening respiratory distress who are not responding to inhaled bronchodilators may benefit from intravenous medications to treat bronchospasm.

Magnesium sulphate

Seek senior emergency/paediatric input as per local escalation protocols for children requiring magnesium sulphate. Consider seeking paediatric critical care input.
Magnesium sulphate is thought to act by decreasing the uptake of calcium by bronchial smooth muscle cells, which leads to bronchodilation. In addition, magnesium may have a role in inhibiting mast cell degranulation, which reduces inflammatory mediators.\textsuperscript{17,18} Whilst there is no clear evidence for magnesium sulphate in the treatment of pre-school wheeze it can be considered for children who are not responding to inhaled therapies.\textsuperscript{11}

**ALERT** – Magnesium should always be prescribed in mmols and administered using safety software syringe drivers to avoid medication errors.

Magnesium sulphate should be administered using safety software syringe drivers with a standard concentration of 0.5 mmol/ml. e.g. a 10 kg child, the magnesium sulphate dose is 0.2mmol/kg = 2 mmol. This translates to 4ml of 0.5 mmol/ml solution, and must be administered through a safety software syringe driver over 10 - 20 minutes to minimise the risk of too rapid administration and dosing errors.

**Magnesium sulphate IV dosing for the treatment of wheeze in pre-school children**

- **Bolus dose**
  
  0.2 mmol/kg (equivalent to 50 mg/kg) infused over 20 minutes
  
  (max 8 mmol = equivalent to 2,000mg)
  
  **Must be administered in syringe driver using safety software.**

- **Side effects**
  
  Usually minor, including:
  
  - epigastric or facial warmth and flushing
  - pain and/or numbness at infusion site
  - dry mouth
  - malaise
  
  Severe reactions include allergy, hypotension, respiratory depression and circulatory collapse

- **Monitoring**
  
  Full cardiac monitoring with blood pressure every 5 minutes. Cease infusion if hypotension persists.

  Monitor knee reflexes if repeating dose to assess for magnesium toxicity which can result in respiratory failure. Magnesium should be ceased/no further doses given if reflexes are absent.

**Intravenous salbutamol**

Contact paediatric critical care specialists (onsite or via RSQ) for children requiring salbutamol IV.

Salbutamol IV should only be used in young children with a very severe acute wheeze.\textsuperscript{24} The dosing recommendation is an initial bolus dose 100mcg/kg (max 5g) given over 20 mins of which is equivalent to 5mcg/kg/min for 20 mins. The child should be closely observed and monitored for signs of salbutamol toxicity (extreme tachycardia, lactic acidosis, and hypertension). If there are significant concerns regarding toxicity, the infusion should be slowed down or ceased. Evaluate the clinical response to this initial dose and consider progression to a salbutamol IV infusion at a rate of 1-10mcg/kg/min. The Asthma Guideline recommends starting at a higher rate initially and reducing thereafter e.g. 5 micrograms/kg/minute for the first hour, then 1–2 micrograms/kg/minute until symptoms improve.

**Salbutamol (IV) dosing for treatment of wheeze in pre-school children**

- **Bolus dose**
  
  100mcg/kg infused over 20 minutes (max 5 milligrams)

- **Infusion**
  
  1-10mcg/kg/min (max weight 50kg)

- **Side effects**
  
  Cumulative doses of salbutamol can cause agitation, tremor, tachycardia, tachypnoea and rarely, hypertension. Raised lactate, hypokalaemia and raised glucose on VBG are markers of salbutamol toxicity.

- **Monitoring**
  
  Full cardiac monitoring. Monitor venous potassium levels.
Intravenous steroids

Seek senior emergency/paediatric input as per local escalation protocols for children requiring steroids IV. Consider seeking paediatric critical care input (onsite or via RSQ).

Whilst oral and parenteral corticosteroids appear to have similar efficacy, steroids IV may be considered in child with a severe wheeze who cannot tolerate oral medication or has a decreased conscious level.

<table>
<thead>
<tr>
<th>Steroid (IV) dosing for the treatment of wheeze in pre-school children</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydrocortisone (IV)</strong></td>
</tr>
<tr>
<td><strong>OR Methylprednisolone (IV)</strong></td>
</tr>
<tr>
<td></td>
</tr>
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<td></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>

Facilities with High Flow Nasal Cannula Oxygen (HFNC) Therapy and Non-Invasive Ventilation (NIV)

HFNC Therapy

Contact paediatric critical care specialists (onsite or via RSQ) for children requiring HFNC therapy.

A randomised controlled study assessing the efficacy of HFNC therapy for children with acute hypoxemic respiratory failure including patients with pre-school wheeze is currently being conducted. The findings will improve our understanding of the role of HFNC therapy for pre-school wheeze. HFNC therapy may help avoid intubation but can also provide pre-oxygenation whilst preparation for inevitable intubation is underway.

ALERT – HFNC therapy and ongoing bronchodilator therapy.

Providing bronchodilator therapy at the same time as HFNC therapy is challenging. A transient decrease to low flow oxygen or use of a specific circuit (where available) is required. Where a circuit is not available, a bolus or infusion of salbutamol IV should be given to children who are too unwell to come off HFNC therapy.

Non-Invasive Ventilation (NIV)

NIV including continuous positive airways pressure (CPAP) or bi-level positive airways pressure (Bi-PAP) can also be considered to help avoid intubation or pre-oxygenate for inevitable intubation e.g. child with a normal level of consciousness who is unable to maintain SpO2 ≥ 94% despite oxygen via a Hudson mask with reservoir, or has deteriorating work of breathing with increasing fatigue, tachycardia, and tachypnoea.

Requirements for HFNC therapy

Potential concerns (QH staff only) have been raised regarding the use of HFNC therapy. Follow local policies and procedures. In accordance with CHQ HFNC therapy protocols (QH staff only), the child:

- should be nursed at an appropriate (1:1 or 1:2) nurse to patient ratio
- should be in an acute area such as a resuscitation room with continuous oximetry and ECG monitoring
- must have vascular access secured
- must remain nil by mouth with consideration given to the placement of a nasogastric tube to prevent gastric insufflation
Medications not routinely recommended

The following medications are not routinely recommended in the acute management of pre-school wheeze:

- hypertonic saline
- oral beta2 agonists (e.g. salbutamol syrup) due to systemic side effects\(^\text{17}\)
- inhaled corticosteroids\(^1\)
- intermittent montelukast\(^\text{17}\)

Chronic management

Preventer medication may be considered for children with recurrent episodes of wheeze (multi-trigger wheeze). Medication should be prescribed by the child’s general practitioner or paediatrician.

### Preventative medications for children with recurrent wheeze episodes (multi-trigger wheeze)

<table>
<thead>
<tr>
<th>Medication</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhaled corticosteroids</td>
<td>3-month trial may be considered RCT of long term inhaled corticosteroid demonstrated improvement (smaller effect than school-aged-children and adults) in symptoms, exacerbation rates, lung function, and airway hyper-responsiveness.(^\text{19,20})</td>
</tr>
<tr>
<td>Leukotriene antagonists</td>
<td>Daily montelukast may be considered as an alternative to inhaled corticosteroids for toddlers with MTW who are at high risk for asthma.(^\text{21}) Parents should be counselled on potential side effects including headaches and mood disturbance/depression.</td>
</tr>
</tbody>
</table>

When to escalate care

Follow your local facility escalation protocols for children of concern. Transfer is recommended if the child requires care beyond the level of comfort of the treating hospital. Clinicians can contact the services outlined below to escalate the care of a paediatric patient.

<table>
<thead>
<tr>
<th>Service</th>
<th>Reason for contact by clinician</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Paediatric service</td>
<td>For specialist paediatric advice and assistance with local transfers as per local arrangements.</td>
<td>As per local arrangements</td>
</tr>
<tr>
<td>Children’s Advice and Transport Coordination Hub (CATCH)</td>
<td>For access to specialist paediatric advice and assistance with inter-hospital transfer of non-critical patients into and out of Lady Cilento Children’s Hospital. For assistance with decision making regarding safe and appropriate inter-hospital transfer of children in Queensland. Click here for the QH Inter-hospital transfer request form</td>
<td>(07) 3068 4510 CATCH website 24 hours</td>
</tr>
<tr>
<td>Telehealth Emergency Management Support Unit (TEMSU)</td>
<td>For access to generalist and specialist acute support and advice via videoconferencing, as per locally agreed pathways, in regional, rural and remote Queensland.</td>
<td>TEMSU QHEPS website 24 hours</td>
</tr>
<tr>
<td>Retrieval Services Queensland (RSQ)</td>
<td>For access to telehealth support for, and to notify of, critically unwell patients requiring retrieval in Queensland. For any patients potentially requiring aeromedical retrieval or transfer in Queensland.</td>
<td>RSQ QHEPS website 24 hours</td>
</tr>
</tbody>
</table>
When to consider discharge

A pre-school child with a wheezing illness may be safely discharged home providing they meet the following criteria:

- well, active child requiring salbutamol no more frequently than 3rd hourly
- SpO2 ≥ 94%
- normal hydration and toleration of diet and fluids
- parent/caregiver can safely manage the child at home, return in event of deterioration and access further medication.

Patients who are at high risk for deterioration with more severe disease or inadequate management in the community should be considered for a period of longer short stay or inpatient observation despite looking well. This includes:

- those with previous PICU admission
- non-English-speaking background
- families living > 30 minutes from a local hospital
- other social factors impacting upon ability to monitor and supervise child at home

An assessment of the family's ability to safely manage the child at home should be done as per the Pre-school Wheeze Disease Education Checklist (PDF) (QH staff only) for all children with pre-school wheeze prior to discharge.

On discharge a child should be provided with:

- Discharge letter
- Wheeze Action Plan – copies for family, general practitioner, and medical record
- Pre-school Wheeze Factsheet and Puffers and Spacers Factsheet

Follow-up

- with GP or paediatrician within a week, depending upon the course of the illness

When to consider admission

Facilities without a Short Stay Unit (SSU)

Consider admission if:

- severe illness – defined as respiratory distress, failure to respond to initial burst of bronchodilator or requiring oxygen
- unable to stretch bronchodilators and discharge by 4 hours

Despite meeting the clinical discharge criteria admission may be considered for the following patients:

- high risk including those with past PICU admission or previous sudden deterioration
- social issues including those who are geographically isolated from a hospital or have family issues affecting the ability to provide care at home

Facilities with a Short Stay Unit (SSU)

Considering admission to a SSU if:

- symptoms occur within 1-2 hours of initial treatment with bronchodilator AND
- no further investigations are required
Children who require bronchodilator therapy more frequently than 1 hourly require vigilant monitoring and regular review by medical staff. Unless specifically discussed with SSU medical and nursing staff, the child should remain in the acute assessment area of the ED.

During admission to SSU:
- salbutamol must be prescribed on a “Variable Frequency” order (for paper-based charting), or as per local electronic medical record capabilities
- vital signs and respiratory assessment should be recorded in line with bronchodilator frequency or hourly if requiring oxygen supplementation
- salbutamol frequency can be weaned (“stretched”) by appropriately trained nursing or medical staff

When to consider admission to inpatient ward from SSU

There is little evidence to support specific requirements however, consider admission for a child with:
- severe illness i.e. respiratory distress or continued need for frequent bronchodilators (every 1 to 2 hours) at 24 hours post presentation
- failure to progress – after 12hrs of care patient has not improved (consider poor bronchodilator responder, suboptimal frequency of administration, or alternate diagnoses)
- supplemental oxygen is required

Related documents

Guideline
- Asthma- Emergency management in children

Forms and factsheets
- Pre-school Wheeze Disease Education Checklist (PDF) (QH staff only)
- Wheeze Action Plan
- Pre-school Wheeze Factsheet
- Puffers and Spacers Factsheet

References

8. Royal Children's Hospital, Melbourne. Acute Asthma. 2015.
26. PARIS 2 Trial – Nasal High Flow Therapy for Infants and Children with Acute Hypoxemic Respiratory Failure – a Randomised Controlled Trial, PREDICT Australia, 2017-2021
27. Schibler et al. A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis.

### Guideline approval

<table>
<thead>
<tr>
<th>Document ID</th>
<th>CHQ-GDL-60009 – Pre-school wheeze</th>
<th>Version no.</th>
<th>1.0</th>
<th>Approval date</th>
<th>13/8/18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive sponsor</td>
<td>Executive Director Medical Services</td>
<td></td>
<td></td>
<td>Effective date</td>
<td>13/8/18</td>
</tr>
<tr>
<td>Author/custodian</td>
<td>Statewide Emergency Care Children Working Group</td>
<td></td>
<td></td>
<td>Review date</td>
<td>13/8/21</td>
</tr>
<tr>
<td>Supercedes</td>
<td>CHQ-GDL-00730 (CHQ Pre-school Wheeze Guideline)</td>
<td></td>
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<td>Applicable to</td>
<td>QH Medical and nursing staff</td>
<td></td>
<td></td>
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<tr>
<td>Authorisation</td>
<td>Executive Director Clinical Services LCCH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keywords</td>
<td>Paediatric, emergency, guideline, wheeze, preschool, pre-school, asthma, 00730, children, 60009</td>
<td></td>
<td></td>
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<tr>
<td>Accreditation references</td>
<td>NSQHS Standards (1-10): 1, 4, 9</td>
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Disclaimer
This guideline is intended as a guide and provided for information purposes only. The information has been prepared using a multidisciplinary approach with reference to the best information and evidence available at the time of preparation. No assurance is given that the information is entirely complete, current, or accurate in every respect.

The guideline is not a substitute for clinical judgement, knowledge and expertise, or medical advice. Variation from the guideline, taking into account individual circumstances may be appropriate.

This guideline does not address all elements of standard practice and accepts that individual clinicians are responsible for:

- Providing care within the context of locally available resources, expertise, and scope of practice
- Supporting consumer rights and informed decision making in partnership with healthcare practitioners including the right to decline intervention or ongoing management
- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary
- Ensuring informed consent is obtained prior to delivering care
- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

Queensland Health disclaims, to the maximum extent permitted by law, all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs incurred for any reason associated with the use of this guideline, including the materials within or referred to throughout this document being in any way inaccurate, out of context, incomplete or unavailable.
Pre-school wheeze - Emergency Management in Children - Flowchart

Pre-school child presents to ED service with wheeze

Initial rapid severity assessment

Mild

Moderate

Severe

Life-threatening

Salbutamol (1 dose)

Salbutamol burst (3 doses)

Salbutamol nebuliser (continuous)

Secondary assessment concurrently with bronchodilator

Mild-moderate

- Salbutamol as required
- Reassess, stretch doses as able

≥ 1 hour between salbutamol doses?

Yes

No

Suitable for stepdown to continue management in SSU or Paediatric Ward

≥ 3 hours between salbutamol doses?

Yes

No

Continue salbutamol as required

Consider referral to inpatient team

≥ 1 hour between salbutamol doses?

Yes

No

Salbutamol as required

Reassess, stretch doses as able

Severe

- Salbutamol as required
- Consider oral steroids
- Reassess

Responding to treatment?

Yes

No

Life-threatening

Salbutamol as required

Consider:
- IV
  - Magnesium sulphate
  - Salbutamol
  - Steroids
  - High flow nasal cannula therapy

Responding to treatment?

Yes

No

Salbutamol as required

Refer to inpatient team

Refer to critical care

For more information refer to the Statewide Paediatric Guideline: Pre-school Wheeze - Emergency Management in Children.

CHQ-GDL-60009 – Pre-school wheeze – Emergency management in children
# Pre-school Wheeze - Emergency Management in Children – Medications

## Inhaled salbutamol dosing for the treatment of wheeze in pre-school children

<table>
<thead>
<tr>
<th></th>
<th>MDI* 100mcg</th>
<th>Nebulised</th>
<th>Salbutamol burst</th>
<th>Continuous nebulised salbutamol</th>
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</thead>
<tbody>
<tr>
<td>&lt; 20 kg</td>
<td>6 puffs</td>
<td>2.5mg</td>
<td></td>
<td>Neat salbutamol nebuliser solution (5mg/mL), replenish where reservoir empty</td>
</tr>
<tr>
<td>&gt;20kg</td>
<td>12 puffs</td>
<td>5mg</td>
<td></td>
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</table>

*Metered dose inhaler. Always use with a spacer. Also use a mask if unable to form a reliable seal around the spacer.

**ALERT** - Cumulative doses of salbutamol can cause agitation, tremor, tachycardia, tachypnoea and rarely, hypertension. Raised lactate, hypokalaemia and raised glucose on VBG are markers of salbutamol toxicity.

## Steroid dosing for the treatment of wheeze in pre-school children

<table>
<thead>
<tr>
<th>Steroid</th>
<th>Po (Day 1: 2mg/kg (max 50mg)</th>
<th>Day 2 and 3: 1mg/kg</th>
<th>Can extend course to 5 days if still symptomatic after 3-day course</th>
<th>Hydrocortisone (IV)</th>
<th>4mg/kg (max 200mg), 6 hourly</th>
<th>OR Methylprednisolone (IV)</th>
<th>Initial loading dose: 2mg/kg (max 60mg)</th>
<th>Then</th>
<th>Day 1: 1mg/kg 6 hourly</th>
<th>Day 2: 1mg/kg 12 hourly</th>
<th>Day 3 onwards: 1mg/kg daily</th>
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## Magnesium sulphate IV dosing for the treatment of wheeze in pre-school children

<table>
<thead>
<tr>
<th>Dosing</th>
<th>Bolus dose</th>
<th>0.2 mmol/kg (equivalent to 50 mg/kg) infused over 20 minutes (max 8 mmol = equivalent to 2,000mg)</th>
<th>Must be administered in syringe driver using safety software.</th>
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</thead>
</table>

**Side effects**

- Usually minor, including:
  - epigastric or facial warmth and flushing
  - pain and/or numbness at infusion site
  - dry mouth
  - malaise

Severe reactions include allergy, hypotension, respiratory depression and circulatory collapse.

**Monitoring**

- Full cardiac monitoring with blood pressure every 5 minutes.
- Cease infusion if hypotension persists.
- Monitor knee reflexes if repeating dose to assess for magnesium toxicity which can result in respiratory failure. Magnesium should be ceased/no further doses given if reflexes are absent.

## Salbutamol IV dosing for the treatment of wheeze in pre-school children

<table>
<thead>
<tr>
<th>Dosing</th>
<th>Bolus dose</th>
<th>100mcg/kg infused over 20 minutes (max 5 milligrams)</th>
</tr>
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</table>

**Infusion**

- 1-10mcg/kg/min (max weight 50kg)

**Monitoring**

- Full cardiac monitoring, monitor potassium levels.