Alberta Acute Childhood Asthma Pathway: Evidence based* recommendations

Inpatient Care: Tertiary and Regional Centres

PHASE I
q1 hour
ASSESSMENT

- O_2 to keep sat ≥ 93%
- clear fluids
- consider IV/labs
- systemic steroids PO or IV
- start inhaled corticosteroids

Entry Point "A"
(on admission)

First Assessment for PRN 30 minutes post inhaled salbutamol

Score ≥ 3
- give PRN post inhaled salbutamol
- notify MD re: PRN
- notify MD if score ≥ 6♣

Score < 3
- no inhaled salbutamol

Second Assessment for PRN 30 minutes post inhaled salbutamol

Score ≥ 3
- give PRN inhaled salbutamol
- notify MD re: PRN
- notify MD if score ≥ 6♣

Score < 3
- no inhaled salbutamol

Third Assessment for PRN 30 minutes post inhaled salbutamol

Score ≥ 3
- give PRN inhaled salbutamol
- MD to assess♣

Score < 3
- no inhaled salbutamol

♣ Pediatrician to assess; determine next course of treatment
- if deterioration: see box below
OR
redirect to top of **Phase I** for continued assessment in 30 minutes; reassess if receive 3 more PRN salbutamol
OR
- if stable/improving but Score 3-5 consider moving to q1 hour assessment

Assessment 1 hour post inhaled salbutamol

Score ≥ 3
- give inhaled salbutamol
- notify MD if score ≥ 6♣

Score < 3
- no inhaled salbutamol

- move to **Phase II** at Entry Point "B"
- needs MD order

< 6 hours in **Phase I**

≥ 6 hours in **Phase I**

MD to assess re: stay in **Phase I** or move to **Phase II** at Entry Point "B"

Deterioration on Inpatient Ward

Consider the following treatment/investigations depending on patient status and response to therapy:

1. Inhaled salbutamol +/- Ipratropium aerosols x 3 back to back or q20 minutes.
2. IV steroid (if on PO steroid and deteriorating) Dose: methylprednisolone 2mg/kg then 1-2mg/kg/day divided q6 hours (max dose 80mg/day or 80mg/dose for first dose).
3. Capillary (or arterial or venous) blood gas and chest Xray.
4. Consider Magnesium sulphate if deterioration unresponsive to increased salbutamol treatment. Monitoring requirements and additional information is included in summary section.

In tertiary center, PICU consult suggested when the patient continues to deteriorate despite interventions or if patient is continuing to require at least q 30 minute inhaled salbutamol or if magnesium sulphate is required.

In regional centers, as patient transport to a tertiary center often requires intubation and intubation should be avoided when possible, patient care at the regional site directed by the pediatrician may be preferred. Consultation support without transport OR discussion of potential transport can be obtained via the tertiary care PICU (or via RAAPID).

PHASE II
q2 hour
ASSESSMENT

- O_2 to keep sat ≥ 93%
- diet as tolerated
- systemic steroids PO
- asthma education
- start/continue inhaled corticosteroids

Entry Point "A"
(on admission)

Assessment for PRN 1 hour post inhaled salbutamol

Score ≥ 6
- give inhaled salbutamol
- notify MD
- return to **Phase I** at Entry Point "A"

Score ≥ 3
- give inhaled salbutamol

Score < 3
- no inhaled salbutamol

Entry Point "B"
(from **Phase I**)

Assessment 2 hours post inhaled salbutamol

Score ≥ 6
- give inhaled salbutamol
- notify MD
- return to **Phase I** at Entry Point "A"

Score ≥ 3
- give inhaled salbutamol

Score < 3
- no inhaled salbutamol

< 24 hours in **Phase II**

≥ 24 hours in **Phase II**

Nurse/RT directed transfer to **Phase III** if:
- ≥ 4 hours in **Phase II**
- no increase in RR or O_2 needs

- MD to consider move to **Phase III**
- until MD decision minimum q2 hour salbutamol

No

No

Yes

Yes

move to **Phase III** at Entry Point "B"

Inpatient Assessment Score (Modified PRAM†)

Signs	0	1	2	3
Suprasternal Indrawing	absent		present	
Scalene Retractions	absent		present	
Wheezing	absent	expiratory only	inspiratory & expiratory	audible without stethoscope/silent chest
Air Entry	normal	decreased at bases	widespread decrease	absent/minimal

Phase Change Criteria: SCORE of < 3 at routine assessment or MD order on a reassessment in Phase I or Phase II.

For salbutamol assessment: if SCORE ≥ 3, give salbutamol, if < 3 no salbutamol.

Repeat PRAM Score 15-30 minutes post any salbutamol treatment.

For any assessment SCORE ≥ 6, give salbutamol and notify MD. If in Phase II or Phase III move back to previous phase. If in Phase I consider further investigations, reassess therapy (salbutamol frequency, IV, oxygen, etc.) and consider PICU consultation if not responding to treatment.

† Excludes O_2 saturation

PHASE III
q4 hour
ASSESSMENT

- O_2 to keep sat ≥ 90%
- diet as tolerated
- systemic steroids PO
- asthma education
- start/continue inhaled corticosteroids

Entry Point "A"
(on admission)

Assessment for PRN 2 hours post inhaled salbutamol

Score ≥ 6
- give inhaled salbutamol
- notify MD
- return to **Phase II** at Entry Point "A"

Score ≥ 3
- give inhaled salbutamol

Score < 3
- no inhaled salbutamol

Entry Point "B"
(from **Phase II**)

Assessment 4 hours post inhaled salbutamol

Score ≥ 6
- give inhaled salbutamol
- notify MD
- return to **Phase II** at Entry Point "A"

Score ≥ 3
- give inhaled salbutamol

Score < 3
- give inhaled salbutamol

< 12 hours in **Phase III**

≥ 12 hours in **Phase III**

CONTACT MD TO CONSIDER DISCHARGE

Yes

No

PROCEED WITH DISCHARGE

While awaiting discharge (eg time of day, social factors, still on O_2) reassessment q4 hours
- **record PRAM score**
- **give inhaled salbutamol every 4 hours**

Abbreviations

BP – Blood Pressure
CBC – Complete Blood Count
CXR – Chest Radiograph
DPI – Dry Powder Inhaler
ED – Emergency Department
FEV1 – Forced Expiratory Volume at one second
HR – Heart Rate
ICS – Inhaled Corticosteroid
ICU – Intensive Care Unit
IV – Intravenous
MDI – Metered Dose Inhaler
NPO – "nothing orally"
PO – "orally"
PICU – Pediatric ICU
PRN – "as needed"
RR – Respiratory Rate

Medications

Salbutamol (Ventolin, Airomir)
Terbutaline (Bricanyl)

Beclomethasone (QVAR)
Budesonide (Pulmicort)
Ciclesonide (Alvesco)
Fluticasone (Flovent)

Budesonide + Formoterol (Symbicort)
Fluticasone + Salmeterol (Advair)
Mometasone + Formoterol (Zenhale)

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Inpatient Care: Tertiary and Regional Centres

Summary of Orders and Inpatient Pathway

1. Diet / Fluids / Electrolytes
- **Diet:** Phase I: consider clear fluids until in Phase II. NPO if not tolerating PO intake or if deteriorating (possible ICU). Resume PO intake as soon as possible. Phase II and III: Diet as tolerated.
- **Fluids:** If vomiting, dehydration, poor intake or prolonged need for q1 hour aersolized salbutamol: IV fluid as needed. D5/0.45 with 20mEq KCl/L (30-40mEq KCl/L if K+ is low). Reduce and discontinue IV as soon as oral intake improves.
- **Electrolytes:** If frequent inhaled salbutamol in ED or on ward, consider labs to check K+. If needing at least maintenance IV fluid, electrolyte check q24 hours recommended.

2. Oxygen
- Phase I and II: Suggest to keep sats ≥ 93%. Periodic saturation checks q2 hours and PRN before aersolized salbutamol.
- Once in Phase III Suggest to keep sats ≥ 90% as long as there is no increased work of breathing.

3. Prednisone/Prednisolone 1-2 mg/kg (max 60mg) PO for 5 days total (Alternate Option (ie. for emesis): Dexamethasone 0.15-0.3mg/kg/dose (max 10mg)). Three to five days of dexamethasone suggested although literature is insufficient to support a particular length of treatment. Evidence regarding equivalency of prednisone and dexamethasone is weak. There are no published studies of dexamethasone use in inpatients.
- Consider IV steroid if unable to tolerate PO, more severe cases or if started in ED due to severity: IV methylprednisolone 2mg/kg load and then start 1-2 mg/kg/day (max 80mg/day) divided q6 hours. Discontinue once oral tolerated or patient is improving and start oral steroids.
- A longer course of therapy may be indicated for those on oral steroids recently prior to admission or if response to therapy has been slow.

4. Pathway Entry/Assessment of Clinical Status
- Modified PRAM score is used to determine if inhaled salbutamol treatment is needed.
- Vital signs: RR, HR to be done with each assessment, BP routine.
- Phase II and III: FEV1 recommended for patients ≥ age 6 for those capable of spirometry, suggest once or twice per day and prior to discharge. May not be possible at all sites due to spirometry accessibility.
- As per ED pathway, assessment for admission occurs at least 4 hours after administration of oral steroids; prior to this interval, ED pathway is most appropriate.
- Admit to Phase I if patient on q1 hourly salbutamol prior to admission.
- Admit to Phase II if patient on q2 hourly salbutamol prior to admission.
- Phase III rarely indicated at admission (usually discharge from ED when on q4 hourly salbutamol).

PHASE I
- If patient is being **admitted into** Phase I Entry Point "A" first assessment is to be done 30 minutes after last inhaled salbutamol then every 30 minutes or 1 hour as per pathway (see algorithm).
- Repeat assessment after inhaled salbutamol (15-30 minutes post), noting response to treatment on assessment form. On post assessment, PRAM may be unchanged and score may be ≥ 3 but do not repeat salbutamol unless clinically indicated.
- If on assessment 1 hour after inhaled salbutamol, score < 3, do not give inhaled salbutamol. Patient is ready to move to Phase II Entry Point "B" (needs MD order).
- If on assessment patient is requiring inhaled salbutamol every 30 minutes on 3 subsequent assessments or if on assessment score is ≥ 6, MD involvement is needed to decide course of therapy which will vary depending on the clinical situation (see algorithm for considerations for MD assessment and when patient is deteriorating).
- After 6 hours in Phase I, MD reassessment re: stay in Phase I or move to Phase II.

PHASE II
- If patient is being **admitted into** Phase II Entry Point "A" first assessment is one hour after last inhaled salbutamol (PRN assessment) then 2 hours after last inhaled salbutamol then every 2 hours as long as inhaled salbutamol required (score ≥ 3).
- If patient is being moved from Phase I to Phase II Entry Point "B" first assessment is done 2 hours after last inhaled salbutamol then every 2 hours as long inhaled salbutamol required (score ≥ 3).
- Repeat assessment after inhaled salbutamol (15-30 minutes post), noting response to treatment on assessment form. On post assessment, PRAM may be unchanged and score may be ≥ 3 but do not repeat salbutamol unless clinically indicated.
- If on assessment 2 hours after inhaled salbutamol, score is < 3, do not give inhaled salbutamol. Patient is ready to move to Phase III Entry Point "B".
- Nurse or RT directed transfer can occur if score < 3, patient has been ≥ 4 hours in Phase II and there has been no increased O_2 needs or increased respiratory rate.
- If greater than 24 hours in Phase II or if score < 3 but criteria for nurse or RT directed transfer are not met, continue salbutamol at minimum of q2 hours and contact MD to consider transfer to Phase III.
- If score ≥ 6, notify MD and return to Phase I Entry Point "A".

PHASE III
- If patient is being **admitted into** Phase III Entry Point "A" first assessment is 2 hours after last inhaled salbutamol and then 4 hours after the last inhaled salbutamol then every 4 hours.
- If patient is being moved from Phase II to Phase III Entry Point "B" first assessment is 4 hours after last inhaled salbutamol then every 4 hours.
- Repeat assessment after inhaled salbutamol (15-30 minutes post),noting response to treatment on assessment form. On post assessment, PRAM may be unchanged and score may be ≥ 3 but do not repeat salbutamol unless clinically indicated.
- If on assessment 4 hours after last inhaled salbutamol score is < 3, give inhaled salbutamol. Patient is ready for potential discharge (see below). If there is a delay in discharge – assess every 4 hours and inhaled salbutamol to be given every 4 hours as a minimum.
- If score ≥ 6, notify MD and return to Phase II Entry Point "A".

5. Salbutamol Therapy by MDI/Spacer is strongly recommended.
- **Dose:** 100mcg/puff weight < 20kg 5 puffs/dose; ≥ 20kg 10 puffs/dose. Once in Phase III reduce to 5 puffs/dose for all weights.
- If less effective, increase by 1-2 puff/dose; if increased side effects (HR, jittery), decrease by 1-2 puff/dose.
- Max MDI dose 10 puffs
- **Alternate:** Nebulization dose 2.5mg/dose for < 20kg and 5mg/dose for ≥ 20kg; nebulization should be considered when patient requires high flow oxygen by face mask, when patient is deteriorating in Phase I and/or becoming fatiqued or when PRAM score is ≥ 8.
- Once in Phase III, can switch to home inhaled β_2 Agonist and ICS device if not being discharged with MDI and Spacer. **Note:** Ventolin Diskus and Bricanyl Turbuhaler 1 puff = 2 puffs inhaled β_2 Agonist by MDI/Spacer.

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Inpatient Care: Tertiary and Regional Centres

6. Ipratropium
- Not recommended routinely for inpatient therapy **BUT** may be used in asthmatic patient who is severe or deteriorating after admission. Use only in first 24 hours of admission.
- **Dose:** MDI (20mcg/puff) 4 puffs/dose **OR** nebulizer 250mcg/dose for all weights, x3 doses given along with each inhaled salbutamol treatment.

7. Long Acting β_2 Agonists or Leukotriene Receptor Antagonists
- Continue usual maintenance therapy.

8. Inhaled Corticosteroid
- Usual therapy should continue in hospital. If no maintenance therapy, begin as soon as possible.
- Suggested dosing in hospital if not previously using daily inhaled cortcosteroid (ICS): Alvesco MDI (200 mcg) 1 puff OD-BID **OR** Flovent MDI (125mcg) 1-2 puffs BID **OR** Flovent Diskus (100mcg) 1-2 puffs BID **OR** Pulmicort Turbuhaler (200mcg) 1- 2 puffs BID **OR** QVAR MDI (100mcg) 1-2 puffs BID.
- In general ICS are of similar effectiveness. However, caution should be exercised when using all inhaled corticosteroids at higher doses because they pose a risk for significant adverse effects such as adrenal axis suppression or inhibition of growth (see online pathway for details*).
- Consideration for DPI is recommended for those age 6 and over; consideration should be given for child preference, parent preference, cost and drug coverage.

9. Magnesium Sulphate
- In Phase I consider Magnesium sulphate if deterioration unresponsive to treatment.
- When considering use of Magnesium sulphate, in a tertiary center, PICU consult should be initiated or if in a regional center, consider seeking advice from PICU.
- **Dosing:** 40 mg/kg IV bolus over 20 minutes (max 2 grams)
- **Monitoring requirements:** magnesium sulphate can cause hypotension, respiratory depression - HR and BP should be closely followed; cardiorespiratory monitoring recommended.

10. Investigations/Antibiotics
- CXR – only if atypical presentation; deterioration after admission; suspected pneumonia.
- Capillary (or arterial or venous) blood gas – if deterioration; altered mental status; underlying chronic lung disease.
- CBC, cultures – if high fever; toxic appearance; clinical deterioration.
- Antibiotics – if definite pneumonia, sinusitis, otitis media.

11. Asthma Education
- Should be completed for all inpatients, best done in Phase II or Phase III.
- Further outpatient asthma education is highly recommended.

12. At tertiary care sites Respirology Consultation should occur when:
- ICU admission.
- Regularly followed by Respiratory Service or Asthma Clinic.
- **Respirology Consultation can be considered when:**
  - Severe exacerbation.
  - Historical features suggestive of poor outpatient management.

13. Discharge Criteria in Phase III:
- Score < 3 on assessment 4 hours after last treatment or 12 hours in Phase III.
- Room air, saturations > 90%.
- Asthma education completed.
- Family able to continue treatment at home.
- Follow-up arranged - Asthma outpatient care is essential; if no family physician able to be obtained, consider outpatient pediatric consultation.
- Continue ICS at discharge until seen by the community care provider.
- Discharge action plan completed and communicated to family and community physician(☆)
- Discharge instructions given to family (☆)
- Prescriptions given (☆)
- For above ☆ discharge items: use triplicate "Pediatric Asthma Discharge Prescription and Short Term Plan" for all purposes (action plan, discharge instructions and prescription) OR use site mandated medication/reconcilliation process and use the duplicate Pediatric Asthma Short Term Plan for action plan and discharge instructions.

Device Recommendations

• 0-4 years: MDI/Spacer with mask • ≥ 4 years: MDI/Spacer with mouthpiece • ≥ 6 years: DPI preferred

Abbreviations

BP – Blood Pressure
CBC – Complete Blood Count
CXR – Chest Radiograph
DPI – Dry Powder Inhaler
ED – Emergency Department
FEV1 – Forced Expiratory Volume at one second
HR – Heart Rate
ICS – Inhaled Corticosteroid
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NPO – "nothing orally"
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Ciclesonide (Alvesco)
Fluticasone (Flovent)

Budesonide + Formoterol (Symbicort)
Fluticasone + Salmeterol (Advair)
Mometasone + Formoterol (Zenhale)

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Pathway Inclusions

Age 1-18 years with asthma; 1st time wheeze if diagnosis is likely asthma; **NOT** bronchiolitis; **NOT** pneumonia unless the pneumonia is felt to be a more minor issue compared to the asthma.

Pathway Entry on Admission

MD to determine Phase to enter on admission based on response to treatment prior to admission.
- As per ED pathway, assessment for admission occurs at least 4 hours after administration of oral steroids; prior to this interval, ED pathway is most appropriate.
- Admit to Phase I if patient on q1 hourly salbutamol prior to admission.
- Admit to Phase II if patient on q2 hourly salbutamol prior to admission.
- Phase III rarely indicated at admission (usually discharge from ED when on q4 hourly salbutamol.

Inpatient Assessment

In ED/urgent care, the PRAM score is used for assessment of severity of exacerbation at triage and following respiratory status.

The inpatient pathway uses a modified PRAM score (see below). The modified PRAM score does not include O_2 saturation.

When reviewing PRAM scores in ED prior to admission, most patients are on oxygen such that their PRAM score will be 1-2 points higher than the inpatient modified PRAM score would be for that same patient.

In the inpatient pathway, the modified PRAM score is used to assess if salbutamol treatment is indicated and to extend the intervals of assessment. The patient moves from Phase I to Phase II to Phase III as their assessment intervals extend from q30-60 minutes to q2 hours and then every 4 hours prior to discharge.

Inpatient Assessment Score (Modified PRAM†)

Signs	0	1	2	3
Suprasternal Indrawing	absent		present	
Scalene Retractions	absent		present	
Wheezing	absent	expiratory only	inspiratory & expiratory	audible without stethoscope/silent chest
Air Entry	normal	decreased at bases	widespread decrease	absent/minimal

Phase Change Criteria: SCORE of < 3 at routine assessment or MD order on a reassessment in Phase I or Phase II.

For salbutamol assessment: if SCORE ≥ 3, give salbutamol, if < 3 no salbutamol.

Repeat PRAM Score 15-30 minutes post any salbutamol treatment.

For any assessment SCORE ≥ 6, give salbutamol and notify MD. If in Phase II or Phase III move back to previous phase. If in Phase I consider further investigations, reassess therapy salbutamol frequency, IV, oxygen, etc.) and consider PICU consultation if not responding to treatment.

† Excludes O_2 saturation

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