

PART  
ONE

# Child Health BC Provincial Asthma Guideline

## Initial Management of Pediatric Asthma in Emergent/Urgent Care Settings

### Background and Evidence

2021-09-30



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### How to cite the CHBC Provincial Asthma Guideline:

We encourage you to share these guidelines with others and we welcome their use as a reference. Please cite each document (part 1 and part 2) in the guideline in keeping with the citation on the table of contents of each of the two documents. If referencing the full guideline, please cite as:

Child Health BC. *Provincial Asthma Guideline; Initial Management of Pediatric Asthma in Emergent/Urgent Care Settings*. Vancouver, BC: Child Health BC, April 2018.

Child Health BC acknowledges the contribution of the Provincial Asthma Working Group. See Part 1, Appendix A for a list of representatives.

This document outlines the methodology used to develop recommendations to support early identification and initial management of children and youth with asthma who present to emergent/urgent care settings across British Columbia. This provincial work was led by Child Health BC (CHBC) in partnership with clinical and content experts, representing rural and urban centers within the various provincial health authorities. The Appraisal of Guidelines for Research and Evaluation II (AGREE II) instrument provided the methodological strategy for the development of this guideline. The following document reviews each component of the AGREE II instrument<sup>23</sup>. The resulting work consists of a package of clinical support documents and educational tools that used together assist the emergency clinician to screen, rapidly assess and begin implementation of interventions in the emergent/urgent care setting. They are not intended for inpatient use.

The provincial resource package includes:

### Guideline Bundle

- Guideline Part One: Evidence and Background (this document)
- Guideline Part Two: Practical Summary and Tools

### Tools

- PRAM Scoring Table
- Management Pathway: for initial management of mild, moderate and severe asthma
- Education Checklist

## Background

### Pediatric Asthma

Pediatric asthma has been identified as a significant health issue in British Columbia (BC). It is the most common chronic disease impacting children and is a leading cause of missed school days and hospital visits<sup>12</sup>. As there is no known cure for asthma; efforts are focused on the delivery of timely and appropriate management strategies to minimize the individual and community level impacts. Children and families can be supported to control their asthma and improve their overall quality of life<sup>13</sup>.

Asthma is a chronic health condition characterized by inflammation of the airway walls and narrowing of the air passages leading to the lungs<sup>13</sup>. Symptoms can be episodic or persistent and present in a variety of ways that include: chest tightness, coughing, wheezing and shortness of breath. These symptoms and episodes of severe shortness of breath can be triggered by exposures such as allergens, environmental irritants, viral infections, exercise and strong emotions<sup>8,12,14</sup>. Poor asthma control can negatively impact a child's overall quality of life, impacting their ability to participate in sports, school and other recreational activities<sup>14</sup>.

### Asthma Diagnosis and Management

The majority of children with asthma present with symptom onset in their preschool years. Preschool aged children have the highest rates of emergency department visits and hospitalizations for asthma symptoms when compared to other age groups. There continues to be uncertainty regarding the diagnosis of asthma in this young age group. This uncertainty can result in delayed treatment and contribute to morbidity in both the short and long term; highlighting the need for early diagnosis and treatment<sup>8</sup>.

Controlling the disease is the primary goal of asthma management and begins with establishing an accurate diagnosis. Diagnosis in children typically includes a thorough medical history and physical examination, supplemented by objective measures of lung functioning for children 6 years of age and older<sup>8,14</sup>. Management strategies include medications, education and environmental controls<sup>15</sup>. “Asthma education is an essential component of asthma management for all patients. Guided self-management, combining asthma education, regular medical review, self-assessment and a written action plan have been shown to reduce hospitalizations, emergency visits, urgent physician visits, missed days at work or school, days of restricted activity, and improved pulmonary function in children” (Canadian Thoracic Society Asthma Committee, 2010, p.18).

Evidence-based management of pediatric patients experiencing acute asthma symptoms includes repeated doses of Salbutamol and Ipratropium, along with oral corticosteroids within the first sixty minutes of care<sup>3</sup>. Lower rates of hospitalization and the improved use of evidence-based medications are associated with the use of a validated and standardized clinical score. The PRAM is a validated scoring tool used to classify the severity of a pediatric patient’s respiratory distress and subsequent response to treatment<sup>1,2,3</sup>.

## Scope and Purpose

### Child Health BC Provincial Asthma Guideline: Initial Management of Pediatric Asthma in Emergent/Urgent Care Settings

#### Scope

This guideline is for use with Children ages 1 year of age to 17 years of age less 1 day\* presenting with wheezing, or respiratory distress, AND

- Diagnosed to have asthma, or
- Treated 2 times prior with a bronchodilator for wheezing

\*While children less than 1 year of age with their first known episode of wheeze should not be routinely treated as a part of the PRAM pathway, treating physicians may choose to include these children on a case by case basis following their assessment.

#### Target User of this Guideline

PRAM scoring is performed in the Emergency Department or Urgent Care Centre by members of the health care team including: Physicians, Nurse Practitioners, Registered Nurses and Respiratory Therapists.

#### Purpose

This provincial guideline and related tools outline the recommendations for the initial management of pediatric patients presenting to emergent/urgent care settings across British Columbia (BC) with acute asthma exacerbations. The guideline provides recommended actions based on the use of the Pediatric Respiratory Assessment Measure (PRAM)<sup>1,2</sup>.

The **Translating Emergency Knowledge for Kids (TREKK) Bottom Line Recommendations: Asthma (2017)** were used as the foundation for building this guideline<sup>3</sup>.

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## Methodology

The Appraisal of Guidelines for Research and Evaluation II (AGREE II) instrument provided the methodological strategy for the development of this guideline<sup>23</sup>.

### Literature Search Strategy

The provincial working group was aware that TREKK had completed a comprehensive literature review and had developed updated Bottom Line Recommendations for Asthma (2017). The TREKK review included:

- 4 systematic reviews
- 2 meta-analysis
- 3 key studies
- Review of existing guidelines

The TREKK Bottom Line Recommendations were reviewed by the working group and it was determined that these recommendations would be used as the basis for the provincial guideline and care algorithm. As a part of this determination the provincial working group reviewed original papers that were included in the systematic review and other literature as relevant. An additional scoping review was completed to gather and review existing guidelines and explore specific components within the guideline. Specifically additional information was sought to inform medication dosing and teaching recommendations.

### Methods for Formulating Recommendations

Based on the information listed above, pediatric recommendations were accepted by the provincial working group. Recommendations requiring provincial adaptation (e.g. medication calculations for pharmacy) were adapted by seeking advice and consensus from clinical experts across the Health Authorities. A series of provincial meetings were held to review the guideline (Part B) and care algorithm, line by line and seek consensus. Draft documents were distributed to the working group members following each set of revisions and feedback was reviewed at the next meeting. Once a final draft was agreed upon the provincial working group members and the CHBC Regional Coordinators were asked to circulate for wider feedback within the Provincial Health Authorities. Feedback was collected and final revisions were circulated to the group for consensus. Acceptance of the guideline was sought from the CHBC steering committee and the Provincial Emergency Services Advisory Council.

### Procedure for Updating the Guideline

This guideline will be reviewed every three years (or earlier if new evidence is published) by a multidisciplinary provincial advisory group consisting of clinical experts in emergency and respiratory care. This guideline was reviewed in Sept. 2021 by Drs. Simi Khangura and Connie Yang, BC Children's Hospital, to coincide with the release of new CTS guidelines. The guideline will be reviewed again in 2024.

## Summary of Recommendations with Levels of Evidence

The following section will outline the key recommendations and assign a level of evidence based on the table below. This level of effectiveness rating scheme is based on the following: Ackley, B. J., Swan, B. A., Ladwig, G., & Tucker, S. (2008). *Evidence-based nursing care guidelines: Medical-surgical interventions*. (p. 7). St. Louis, MO: Mosby Elsevier.

Level of evidence (LOE)	Description
Level I	Evidence from a systematic review or meta-analysis of all relevant RCTs (randomized controlled trial) or evidence-based clinical practice guidelines based on systematic reviews of RCTs or three or more RCTs of good quality that have similar results.
Level II	Evidence obtained from at least one well-designed RCT (e.g. large multi-site RCT).
Level III	Evidence obtained from well-designed controlled trials without randomization (i.e. quasi-experimental).
Level IV	Evidence obtained from well-designed case-control or cohort studies
Level V	Evidence from systematic reviews of descriptive and qualitative studies (meta-synthesis)
Level VI	Evidence from a single descriptive or qualitative study.
Level VII	Evidence from the opinion of authorities and/or reports of expert committees.

Recommendation	Level of Evidence	Additional Information
<b>ASSESSMENT</b>		
<b>Pediatric Respiratory Assessment Measure:</b> Use of a standardized, validated clinical score (the Pediatric Respiratory Assessment Measure or PRAM) to classify the severity of respiratory distress in children with asthma exacerbations results in improved use of evidence-based medications and lower rates of hospitalization.	Specifically recommended in the TREKK Bottom Line Recommendations <sup>3</sup>  The papers supporting this recommendation were Level IV	Large prospective cohort studies (Ducharme et al.,2008; Chalut, Ducharme & Davis,2000)  Expert opinion

<b>MANAGEMENT</b>		
<p><b>Evidence-based management</b> of children with acute asthma exacerbations (including repeated doses of salbutamol and ipratropium, and oral corticosteroids in the first 60 minutes of care) reduces hospitalization rates substantially.</p>	<p>Specifically recommended in the TREKK Bottom Line Recommendations<sup>3</sup></p> <p>The papers supporting this recommendation were Level I</p>	<p>Cochrane Database Systematic Review<sup>18</sup> (Griffiths &amp; Ducharme, 2013)</p>
<p><b>Inclusion criteria</b></p> <p>This guideline is for use with Children ages 1 year of age to 17 years of age less 1 day* presenting with wheezing, or respiratory distress, AND</p> <ul style="list-style-type: none"> <li>• Diagnosed to have asthma, or</li> <li>• Treated 2 times prior with a bronchodilator for wheezing</li> </ul> <p>*While children less than 1 year of age with their first known episode of wheeze should not be routinely treated as a part of the PRAM pathway, treating physicians may choose to include these children on a case by case basis following their assessment.</p>	<p>Level VII</p>	<p><b>The use of ages 1-17:</b> is consistent with the Ontario Lung Association’s clinical pathway that has been endorsed by the Canadian Paediatric Society, Canadian Society of Hospital Pharmacists, Canadian Thoracic Society, The Registered Nurses Association of Ontario, The Respiratory Therapy Society of Ontario, Emergency Nurses Association of Ontario and The Family Physicians Airway Group of Canada (The Lung Association Ontario, 2014).</p> <p><b>Inclusion criteria</b> decision based on consensus at provincial meeting #2 and consistent with Fraser Health, Island Health and BCCH pathways</p> <p>Consensus of provincial working group at meeting number 2 to include children ages 1-16.99 with the asterisk to allow for consideration of younger children. This is consistent with Alberta Health Services pathway.</p>
<p><b>Consider supplementing the PRAM score with objective markers of airway obstruction</b> such as peak-flow or spirometry. Particularly in patients with a history of severe exacerbations.</p>	<p>Level VII</p>	<p>Expert opinion based on data. Provincial group consensus.</p> <p>Older children may present with a lower PRAM score despite having a low FEV1 (Forced expiratory volume measured during the first second of the forced breath)<sup>5</sup> (Arnold, Gebretsadik &amp; Hartert, 2013).</p>

<b>Dose references and monitoring</b>	Level VII	Provincial group consensus and expert opinion
<b>Discharge follow up recommendations</b>	Level VII	Provincial group consensus and expert opinion
<b>Mild Category Key Recommendations</b>		
Salbutamol should be delivered with metered dose inhalers (MDIs) and spacers rather than nebulization.	Specifically recommended in the TREKK Bottom Line Recommendations <sup>3</sup>  The papers supporting this recommendation were Level I	Cochrane Database Systematic Review <sup>16</sup> (Cates, Crilly, & Rowe, 2013)
For children experiencing MILD respiratory distress, there is no clear evidence supporting the administration of oral corticosteroids.	No clear evidence found to support use	TREKK Bottom Line Recommendation <sup>3</sup>
<i>Criteria for safe discharge home</i> –no significant indrawing and/or subasternal indrawing at least one to two hours after the last bronchodilator treatment and other assessments that equates to PRAM score of $\leq 3$	Specifically recommended in the TREKK Bottom Line Recommendations <sup>3</sup>  Level VII	Expert opinion and consensus
<b>Moderate Category Key Recommendations</b>		
Salbutamol should be delivered with metered dose inhalers (MDIs) and spacers rather than nebulization. Treat with Salbutamol every 20 minutes for three doses.	Specifically recommended in the TREKK Bottom Line Recommendations <sup>3</sup>  The papers supporting this recommendation were Level I	Cochrane Database Systematic Review <sup>16</sup> (Cates, Crilly, & Rowe, 2013)
Administration of oral corticosteroids just before or immediately after initiating bronchodilator therapy substantially decreases respiratory distress within 2-6 hours of treatment and substantially decreases hospitalization rates.	Specifically recommended in the TREKK Bottom Line Recommendations <sup>3</sup>  The papers supporting this recommendation were Level I	Systematic review and meta analysis <sup>17</sup> (Keeney et al., 2014).
Oral dexamethasone or prednisone/prednisolone are likely	Specifically recommended in the TREKK Bottom Line	Systematic review and meta



to be comparably effective. Some studies have reported substantially lower rates of vomiting with dexamethasone.	Recommendations <sup>3</sup>  The papers supporting this recommendation were Level 1	analysis <sup>17</sup> (Keeney et al., 2014)
Multiple doses of ipratropium (two to three) added to salbutamol aerosols and oral corticosteroids in the first 60 minutes of treatment yield greater improvement and lower hospital rates. Benefits appear to be greatest in those with severe respiratory distress; it is less certain in those children with moderate distress.	Specifically recommended in the TREKK Bottom Line Recommendations <sup>3</sup>  The papers supporting this recommendation were Level I	Cochrane Database Systematic Review <sup>18</sup> (Griffiths & Ducharme, 2013)
<b>Severe Category Key Recommendations</b>		
Patients with severe respiratory distress improve more rapidly when bronchodilators are delivered continuously via aerosol over 60 to 180 minutes as compared to intermittently.	Specifically recommended in the TREKK Bottom Line Recommendations <sup>3</sup>  The papers supporting this recommendation were Level I	Cochrane database systematic review <sup>19</sup> (Camargo et al., 2003)
Although delivery via MDI/spacers is more efficient than nebulization, it is much more convenient to deliver aerosols continuously via nebulization than via MDI/spacers.	Specifically recommended in the TREKK Bottom Line Recommendations <sup>3</sup>  Level VII	TREKK Bottom Line Recommendation <sup>3</sup>
Large volume nebulizers allow administration of bronchodilators continuously over 60 minutes or more, and should be used in preference to standard-sized nebulizers.	Specifically recommended in the TREKK Bottom Line Recommendations <sup>3</sup>  The papers supporting this recommendation were Level II	Randomized Control Trials <sup>20</sup> (Westmed HEART Continuous Nebulizers, large-volume nebulizer used in RCTs)
Children with severe respiratory distress who do not respond to repeated or continuous bronchodilators and oral corticosteroids have been shown to have greater subsequent improvement if treated with intravenous magnesium sulfate (in addition to repeated or continuous bronchodilator therapy).	Specifically recommended in the TREKK Bottom Line Recommendations <sup>3</sup>  The papers supporting this recommendation were Level I	Cochrane Systematic review and meta-analysis <sup>21,22</sup> (Cheuk, Chau & Lee, 2005; Griffiths & Kew, 2016)

## Appendix A: Acknowledgments

This group would like to acknowledge the many health care professionals who contributed to the development of this guideline by sharing their expert opinion and by acting as reviewers. In addition to the working group members, Connie Yang, MD, FRCP(C), MSc (Clinical Assistant Professor, Division of Respiratory Medicine British Columbia Children's Hospital) and Simi Khangura MD, FRCP(C) (Clinical Associate Professor Division of Emergency Medicine, Department of Pediatrics, UBC, BC's Children's Hospital) provided significant input into the development of the guideline and accompanying algorithm.

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## Appendix B: Applicability

Educational materials to support the implementation of this guideline were created by Child Health BC with the input of provincial partners.

The resource toolkit for frontline staff and physicians includes:

- power point presentations for nursing and physicians
- educational webinar
- simulation materials including case scenarios

Implementation strategies may vary between health authorities and individual sites with the consideration of factors such as: educational needs, service population, geographical location, operational structure and available resources.

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## Appendix C: Editorial Independence

There are no conflicts of interest to report.

### i. Disclaimer

Child Health BC develops evidence-based clinical support documents that include recommendations for the care of children and youth across British Columbia. These documents are intended to give an understanding of a clinical problem, and outline one or more preferred approaches to the investigation and management of the problem. These documents are for guidance only and not intended as a substitute for the advice or professional judgment of a health care professional, nor are they intended to be the only approach to the management of a clinical problem. Healthcare professionals should continue to use their own judgment and take into consideration context, resources and other relevant factors. Neither Provincial Health Services Authority nor Child Health BC assume any responsibility or liability from reliance on or use of the documents.

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## Appendix D: Resources

### Related Documents

Appraisal of Guidelines for Research and Evaluation II Instrument (AGREE II)  
<http://www.agreetrust.org/resource-centre/agree-reporting-checklist/>

BC Guidelines: Asthma in Children-Diagnosis and Management Guideline, BC  
<http://www.bcguidelines.ca>

College of Registered Nurses of British Columbia Scope of Practice for Registered Nurses  
[https://www.bccnp.ca/Standards/RN\\_NP/StandardResources/RN\\_ScopeofPractice.pdf](https://www.bccnp.ca/Standards/RN_NP/StandardResources/RN_ScopeofPractice.pdf)

Pediatric Asthma: Initial Management Pathway in an Emergency Setting (Appendix A)

Provincial PEWS Vital Sign, Assessment and Documentation Guidelines  
<http://www.childhealthbc.ca/>

Translating Emergency Knowledge for Kids (TREKK) Bottom Line Recommendations: Asthma  
<http://trekk.ca/>

### Resources

Asthma Fillable Action Plans Ages 1-5 and 6-18  
<http://www.childhealthbc.ca/> or <http://www.bcguidelines.ca>

### References

- 1) Ducharme, F.M., Chalut, D., Plotnick, L., Savdie, C., Kudirka, D., Zhang, X., Meng, L., & McGillivray, D. (2008). The pediatric respiratory assessment measure: A valid clinical score for assessing acute asthma severity from toddlers to teenagers. *Journal of Pediatrics*, 152(4), 476-80.
- 2) Chalut, D.S., Ducharme, F.M., & Davis, G.M. (2000). The preschool respiratory assessment measure (PRAM): A responsive index of acute asthma severity. *Journal of Pediatrics*, 137(6), 762-768.
- 3) Translating Emergency Knowledge for Kids (TREKK). (2016). *Bottom line recommendations: asthma*. Retrieved from <https://kte01.med.umanitoba.ca/assets/trekk/assets/attachments/130/original/asthma-bottom-line-final-correct-bc-link.pdf?1481300814>

- 4) College of Registered Nurses of British Columbia. (2017). *Scope of practice for registered nurses*. Retrieved from [https://www.bccnp.ca/Standards/RN\\_NP/StandardResources/RN\\_ScopeofPractice.pdf](https://www.bccnp.ca/Standards/RN_NP/StandardResources/RN_ScopeofPractice.pdf)
- 5) Arnold, D. H., Gebretsadik, T., & Hartert, T.V. (2013). *Spirometry and PRAM severity score changes during pediatric acute asthma exacerbation treatment in a pediatric emergency department*. *J Asthma*, 50:204–208.
- 6) BC Guidelines. (2015). *Asthma in children-Diagnosis and management guideline, BC*. Retrieved from <http://www.bcguidelines.ca>
- 7) Clinical Research and Knowledge Transfer Unit on Childhood Asthma (CRUCA) of the Research Centre of Sainte-Justine University Hospital Center. *Paediatric Respiratory Assessment Measure (PRAM) Teaching Module*. Retrieved from <http://www.chu-sainte-justine.org/pram>
- 8) Ducharme, F.M., Dell, S.D., Radhakrishnan, D., Grad, R.M., Watson, W.T.A., Yang, C.L., & Zelman, M. (2015). Diagnosis and management of asthma in preschoolers: A Canadian thoracic society and Canadian paediatric society position paper. *Canadian Respiratory Journal*, 22 (3), 135-143.
- 9) Lehr, A.R., McKinney, M.L., Gouin, S., Blais, J.G., Pusic, M.V., & Ducharme, F.M. (2013). Development and pretesting of an electronic learning module to train health care professionals on the use of the pediatric respiratory assessment measure to assess acute asthma severity. *Canadian Respiratory Journal*, 20(6), 435-41.
- 10) Ontario Lung Association. (2014). Paediatric emergency department asthma clinical pathway (P- EDACP). Retrieved from <https://www.on.lung.ca/file/PEDACP-Information-Package.pdf>
- 11) Canadian Pediatric Society (2012). *Managing the paediatric patient with an acute asthma exacerbation*. Canadian Pediatric Society Position Statement. *Paediatric Child Health* 2012; 17 (5): 251-5. Reaffirmed Feb 28 2015.
- 12) U.S National Library of Medicine. (2012). *Asthma-children*. Retrieved from (<https://www.nlm.nih.gov/medlineplus/ency/article/000990.htm>)
- 13) World Health Organization. (2013). Asthma fact sheet. Retrieved from <http://www.who.int/mediacentre/factsheets/fs307/en/>
- 14) Canadian Institute for Health Information (CIHI). (2001). *Respiratory disease in Canada*. Retrieved from [https://secure.cihi.ca/free\\_products/RespiratoryComplete.pdf](https://secure.cihi.ca/free_products/RespiratoryComplete.pdf)
- 15) Loughheed, M. D., Lemièrre, C., Dell, S. D., Ducharme, F. M., Fitzgerald, J. M., Leigh, R. (2010). Canadian Thoracic Society Asthma Committee. Canadian thoracic society asthma management continuum--2010 consensus summary for children six years of age and over, and adults. *Canadian Respiratory Journal: Journal of the Canadian Thoracic Society*, 17(1), 15.

- 16) Cates CJ, Crilly JA, Rowe BH. (2013). Holding chambers (spacers) versus nebulizers for beta-agonist treatment of acute asthma. *Cochrane Database Syst Rev.* 13;(9):CD000052. doi: 10.1002/14651858.CD000052.pub3.
- 17) Keeney, G.E. et al. (2014). Dexamethasone for acute asthma exacerbations in children: A meta-analysis. *Pediatrics.* Mar 1;133(3):493-9.
- 18) Griffiths, B. & Ducharme, F.M. (2013). Combined inhaled anticholinergics and short-acting beta2-agonists for initial treatment of acute asthma in children. *Cochrane Database Syst Rev.* 2013 Aug 21;(8).
- 19) Camargo, C.A. Jr et al. (2003). Continuous versus intermittent beta-agonists in the treatment of acute asthma. *Cochrane Database Syst Rev.* 2003;(4):CD001115.
- 20) Order information for MiniHEART Hi-Flo<sup>®</sup>, Westmed HEART Continuous Nebulizers (large-volume nebulizer used in RCTs).
- 21) Cheuk, D.K., Chau, T.C. & Lee, S.L.(2005). A meta-analysis on intravenous magnesium sulphate for treating acute asthma. *Arch Dis Child.* 2005 Jan;74-7.
- 22) Griffiths, B. & Kew, K.M. (2016). Intravenous magnesium sulfate for treating children with acute asthma in the emergency department. *Cochrane Database Syst Rev.* 2016; (4):CD011050.
- 23) Brouwers. M., Kho, M.E., Browman, G.P., Burgers, J.S., Cluzeau, F., Feder, G., Fervers, B., Graham, I.D., Grimshaw, J., Hanna, S., Littlejohns, P., Makarski, J., & Zitzelsberger, L. (2010). For the AGREE Next Steps Consortium. AGREE II: Advancing guideline development, reporting and evaluation in healthcare. *Can Med Assoc J.* 2010. Dec 2010; 182:E839-842; doi:10.1503/090449