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Nursing Best Practice Guideline
Shaping the future of Nursing

Promoting Asthma Control in Children

Registered Nurses Association of Ontario
Association des infirmières et infirmiers autorisés de l'Ontario

Greetings from Doris Grinspun
Executive Director
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It is with great excitement that the Registered Nurses Association of Ontario (RNAO) disseminates this nursing best practice guideline to you. Evidence-based practice supports the excellence in service that nurses are committed to deliver in our day-to-day practice.

We offer our endless thanks to the many institutions and individuals that are making RNAO's vision for Nursing Best Practice Guidelines (NBPGs) a reality. The Ontario Ministry of Health and Long-Term Care recognized RNAO's ability to lead this project and is providing multi-year funding. Tazim Virani – NBPG project director – with her fearless determination and skills, is moving the project forward faster and stronger than ever imagined. The nursing community, with its commitment and passion for excellence in nursing care, is providing the knowledge and countless hours essential to the creation and evaluation of each guideline. Employers have responded enthusiastically to the request for proposals (RFP), and are opening their organizations to pilot test the NBPGs.

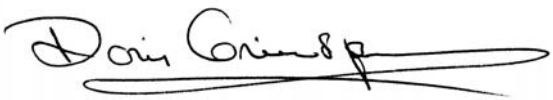
Now comes the true test in this phenomenal journey: will nurses utilize the guidelines in their day-to-day practice?

Successful uptake of these NBPGs requires a concerted effort of four groups: nurses themselves, other healthcare colleagues, nurse educators in academic and practice settings, and employers. After lodging these guidelines into their minds and hearts, knowledgeable and skillful nurses and nursing students need healthy and supportive work environments to help bring these guidelines to life.

We ask that you share this NBPG, and others, with members of the interdisciplinary team. There is much to learn from one another. Together, we can ensure that Ontarians receive the best possible care every time they come in contact with us. Let's make them the real winners of this important effort!

RNAO will continue to work hard at developing and evaluating future guidelines. We wish you the best for a successful implementation!

Doris Grinspun, RN, MScN, PhD (candidate)



Executive Director
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How to Use this Document

This nursing best practice guideline is a comprehensive document providing resources necessary for the support of evidence-based nursing practice. The document needs to be reviewed and applied, based on the specific needs of the organization or practice setting/environment, as well as the needs and wishes of the client. Guidelines should not be applied in a "cookbook" fashion but used as a tool to assist in decision making for individualized client care, as well as ensuring that appropriate structures and supports are in place to provide the best possible care.

Nurses, other health care professionals and administrators who are leading and facilitating practice changes will find this document valuable for the development of policies, procedures, protocols, educational programs, assessment and documentation tools, etc. It is recommended that the nursing best practice guidelines be used as a resource tool. Nurses providing direct client care will benefit from reviewing the recommendations, the evidence in support of the recommendations and the process that was used to develop the guidelines. However, it is highly recommended that practice settings/environments adapt these guidelines in formats that would be user-friendly for daily use. This guideline has some suggested formats for such local adaptation and tailoring.

Organizations wishing to use the guideline may decide to do so in a number of ways:

- Assess current nursing and health care practices using the recommendations in the guideline.
- Identify recommendations that will address identified needs or gaps in services.
- Systematically develop a plan to implement the recommendations using associated tools and resources.

RNAO is interested in hearing how you have implemented this guideline. Please contact us to share your story. Implementation resources will be made available through the RNAO website to assist individuals and organizations to implement best practice guidelines.

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Nursing Best Practice Guideline

Promoting Asthma Control in Children

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Promoting Asthma Control in Children

Disclaimer

These best practice guidelines are related only to nursing practice and not intended to take into account fiscal efficiencies. These guidelines are not binding for nurses and their use should be flexible to accommodate client/family wishes and local circumstances. They neither constitute a liability or discharge from liability. While every effort has been made to ensure the accuracy of the contents at the time of publication, neither the authors nor RNAO give any guarantee as to the accuracy of the information contained in them nor accept any liability, with respect to loss, damage, injury or expense arising from any such errors or omission in the contents of this work. Any reference throughout the document to specific pharmaceutical products as examples does not imply endorsement of any of these products.

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Summary of Recommendations

	RECOMMENDATION	*LEVEL OF EVIDENCE
Assessment of Asthma Control	1.0 All children identified, or suspected of having asthma, will have their level of control determined by the nurse.	Level IV
	1.1 During a nursing assessment of respiratory health, every child should be screened to identify those most likely to be affected by asthma. ■ Have you ever been told you have (your child has) asthma? ■ Have you (has your child) ever used a puffer/inhaler or any type of medication for breathing problems? Have you experienced any improvement with these medications?	Level IV
	1.2 If a child is identified as, or suspected** of, having asthma, the level of control should be assessed based on : ■ short-acting β_2-agonist use ■ daytime symptoms ■ night-time symptoms ■ physical activity ■ absence from school/work ■ exacerbations ** If suspected of having asthma, further evaluation by a physician is required.	Level IV
	1.3 For children identified as potentially having uncontrolled asthma, the level of acuity needs to be assessed by the nurse and an appropriate medical referral provided (i.e., urgent care or follow-up appointment).	Level IV
Medications	2.0 Nurses will understand the pharmacology of medications used to treat asthma in children.	Level IV
	2.1 Nurses will be able to discuss the two main categories of asthma medications (controllers and relievers) with the child and their family members/caregivers, tailoring information for the developmental age of the child.	Level IV
	2.2 All children with asthma should have their inhaler/device technique assessed by the nurse at each visit to ensure accurate use, as well as appropriateness of device for the developmental level of the child. Children with sub-optimal technique will be coached in proper inhaler/device use or switched to a more appropriate delivery device/system.	Level Ib

*Refer to pg. 14 for "Interpretation of Evidence".

		RECOMMENDATION	LEVEL OF EVIDENCE
	2.3	Nurses will be able to assess for potential barriers to asthma management. The nurse will be able to offer strategies to meet families' needs and support them in overcoming issues leading to treatment failure.	Level IV
Asthma Education	3.0	The nurse will provide asthma education, in collaboration with the health care team, as an essential part of care.	Level Ia
	4.0	Child/family knowledge of asthma should be assessed by the nurse at each patient contact. Asthma education should be provided when knowledge and skill gaps are identified.	Level Ia
	4.1	Tailor asthma education to the needs of the child and family by being developmentally appropriate, sensitive to cultural beliefs and practices, and by using a variety of teaching methods (e.g., video, pamphlets, websites, group, role playing, problem-solving).	Level IV
	5.0	The nurse can use a structured framework to build both the child's and family's knowledge of asthma and self-management skills by providing basic asthma education. A partnership between the nurse, child and family is important to engage the child and family in an interactive educational process.	Level IV
Action Plans	6.0	All children will have an individualized asthma action plan for guided self-management, based on the evaluation of symptoms, with or without peak flow measurements, developed in partnership with a health care professional.	Level Ia
	6.1	The action plan must be reviewed, revised and reinforced in partnership with the parent/caregiver, child and health care professional during every contact. The nurse will coach the parent to act as an advocate for their child, ensuring that the action plan is kept up to date.	Level Ia
Referral and Follow-up	7.0	The nurse should facilitate follow-up assessments and education to achieve and maintain control of asthma for the child diagnosed with asthma.	Level Ia
	7.1	The nurse will determine the child's primary care asthma management provider by asking "who do you see for your asthma management?"	Level IV

	RECOMMENDATION		LEVEL OF EVIDENCE
	7.2	Nurses should advocate for a referral to an asthma specialist (respirologist, allergist, paediatrician, Certified Asthma Educator, etc.) for the following: frequent visits to the emergency department; poor understanding of asthma self-management; symptoms are not responding to usual treatment; and/or uncertainty of diagnosis.	Level IV
	7.3	Nurses should advocate for referral to an asthma education program and/or link to community resources, if available.	Level IV
Education Recommendations	8.0	Nurses working with children with asthma must have the appropriate knowledge and skills to: ■ identify the level of asthma control; ■ provide basic developmentally appropriate asthma education; and ■ identify the need for follow-up with primary care provider and/or community resources.	Level IV
Organization and Policy Recommendations	9.0	Organizational leadership must maintain a commitment to best practice guideline implementation.	Level IV
	9.1	Organizations must maintain a commitment to sustain the healthy work environment required to support guideline implementation: ■ a critical mass of nurses educated and supported in guideline implementation; ■ care delivery systems and adequate staffing that support the nurses' ability to implement these guidelines; and ■ a sustained commitment to evidence-based practice in paediatric asthma care.	Level IV
	9.2	Organizations must promote a collaborative practice model within a multidisciplinary team to enhance asthma care. This approach must include all health care professionals and community caregivers involved with the child.	Level IV
	9.3	Organizations need to plan and provide appropriate material resources to implement these best practice guidelines. Specifically, they must have: ■ placebos and spacer devices for teaching; ■ sample templates for action plans; ■ educational materials; ■ documentation tools ■ resources for child/family and nurse education; and ■ peak flow or other monitoring equipment, when indicated.	Level IV

	RECOMMENDATION	LEVEL OF EVIDENCE
	9.4 Organizations are encouraged to develop key indicators and outcome measurements that will allow them to monitor the implementation of the guidelines, the impact of the guidelines on optimizing quality patient care, as well as any efficiencies, or cost effectiveness achieved.	Level IV
	10.0 Nursing best practice guidelines can be successfully implemented only where there are adequate planning, resources, organizational and administrative support, as well as appropriate facilitation. Organizations may wish to develop a plan for implementation that includes: ■ An assessment of organizational readiness and barriers to education. ■ Involvement of all members (whether in a direct or indirect supportive function) who will contribute to the implementation process. ■ Dedication of a qualified individual to provide the support needed for the education and implementation process. ■ Ongoing opportunities for discussion and education to reinforce the importance of best practices. ■ Opportunities for reflection on personal and organizational experience in implementing guidelines. In this regard, RNAO (through a panel of nurses, researchers and administrators) has developed the *Toolkit: Implementation of Clinical Practice Guidelines* based on available evidence, theoretical perspectives and consensus. The *Toolkit* is recommended for guiding the implementation of the RNAO guideline *Promoting Asthma Control in Children*.	Level IV
	11.0 Government agencies responsible for the allocation of funding must recognize the critical role of a seamless continuum of care in promoting asthma control in children. This must include recognition and funding for the following: ■ health promotion activities provided by Public Health Nurses in such venues as schools; ■ acute care provided by nurses as part of health care teams in hospitals and community physician offices; and ■ long-term care, provided by community health nurses in family homes.	Level IV
	12.0 Nurses should seek opportunities to advocate for the promotion of optimal asthma care for children and families affected by asthma.	Level IV

Interpretation of Evidence

LEVEL Ia	Evidence obtained from meta-analysis or systematic review of randomized controlled trials.
LEVEL Ib	Evidence obtained from at least one randomized controlled trial.
LEVEL IIa	Evidence obtained from at least one well-designed controlled study without randomization.
LEVEL IIb	Evidence obtained from at least one other type of well-designed quasi-experimental study without randomization.
LEVEL III	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies.
LEVEL IV	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities

Responsibility for Development

The Registered Nurses Association of Ontario (RNAO), with funding from the Ministry of Health and Long-Term Care, has embarked on a multi-year project of nursing best practice guideline development, pilot implementation, evaluation and dissemination. In this fourth cycle of the project, one of the areas of emphasis is on the assessment and management of asthma in children. This guideline was developed by a panel of nurses and researchers convened by the RNAO conducting its work independent of any bias or influence from the Ministry of Health and Long-Term Care.

Purpose and Scope

Best practice guidelines are systematically developed statements to assist practitioners' and clients' decisions about appropriate health care (Field & Lohr, 1990). This best practice guideline focuses on assisting nurses working in diverse practice settings in providing basic asthma care for children and their families.

The goal of this document is to promote asthma control in children, from infancy through to 18 years of age.

Nurses, working in partnership with the multidisciplinary health care team, have an important role in promoting the control of asthma in children through key interventions of assessment, education and referral across diverse contexts and settings. This guideline focuses on children who have a diagnosis of asthma along with their families, and includes recommendations for developmentally appropriate assessment, management, education, referral and follow-up. For simplicity throughout the document, the word "child" or "children" will be used to refer to individual(s) from birth to 18 years of age. For individuals 18 years of age and older, refer to the RNAO nursing best practice guideline *Adult Asthma Care Guidelines for Nurses: Promoting Control of Asthma (2004).*

The guideline contains recommendations for Registered Nurses and Registered Practical Nurses on best nursing practices in the area of paediatric asthma. It is intended for nurses who may not be experts in asthma care and who work in a variety of practice settings across

the continuum of care. It is acknowledged that the individual competencies of nurses varies between nurses and across categories of nursing professionals and are based on knowledge, skills, attitudes, critical analysis and decision making which are enhanced over time by experience and education. It is expected that individual nurses will perform only those aspects of asthma assessment and management for which they have appropriate education and experience and that they will seek appropriate consultation in instances where the client's care needs surpass their ability to act independently.

It is acknowledged that effective health care depends on a coordinated multidisciplinary approach incorporating ongoing communication between health professionals and clients/families, ever mindful of the unique circumstances and best interests of the child and their family. In addition, nurses have a responsibility to consider the safety of the child, and the evolution of autonomy for decision making through various developmental stages.

Key Points

- This document focuses on assisting nurses working in diverse practice settings in providing basic asthma care to children.
- Nurses will function within their scope of practice and seek appropriate consultation beyond their scope.
- Nurses working with children and their families need to consider the child's safety, best interests and autonomy for decision making.

Development Process

In January of 2003, a panel of nurses and researchers with expertise in asthma care, asthma education and asthma research, from institutional, community and academic settings was convened under the auspices of the RNAO. The development phase was initiated by the compilation of a set of eighteen existing practice guidelines for the assessment and management of asthma, all of which included content related to children. These guidelines were identified through a structured search, the details of which are described in Appendix A. These documents were reviewed according to a set of inclusion criteria, which resulted in the elimination of ten guidelines. The screening criteria included the following: guideline is in English; guideline dated no earlier than 1997; guideline is strictly about the topic area; guideline is evidence-based; and guideline is available and accessible for retrieval.

Eight guidelines were critically appraised for the purpose of identifying existing guidelines that were current, developed with rigour, evidence-based and addressed the scope identified by the panel for the best practice guideline. A quality appraisal was conducted on eight clinical practice guidelines using the *Appraisal of Guidelines for Research and Evaluation Instrument* (AGREE Collaboration, 2001). This process yielded a decision to work primarily with six existing guidelines. These were:

Boulet, L. et al. (1999). Canadian asthma consensus report: 1999. Canadian Medical Association. [On-line]. Available: http://www.cmaj.ca/cgi/reprint/161/11_suppl_1/s1.pdf

British Thoracic Society and Scottish Intercollegiate Guidelines Network (2003). British guideline on the management of asthma. [On-line]. Available: http://www.sign.ac.uk/guidelines/fulltext/63/index.html

Global Initiative for Asthma (2002). Global strategy for asthma management and prevention. [On-line]. Available: http://www.ginasthma.com

Institute for Clinical Systems Improvement (2002). Health care guideline. Diagnosis and management of asthma. [On-line]. Available: http://www.ICSI.org

National Institutes of Health (1997). *Guidelines for the diagnosis and management of asthma* (Rep. No. 2). NIH Publication.

National Institutes of Health. (2002). National asthma education and prevention program expert panel report: Guidelines for the diagnosis and management of asthma update on selected topics – 2002. *The Journal of Allergy and Clinical Immunology, 110*(5), S141-S219.

An update to the 1999 Canadian Asthma Consensus Report was not included in the initial AGREE review, however the panel determined that this document should be included as a companion to the Boulet et al. (1999) document:

Boulet, L., Bai, T.R., Becker, A., Berube, D., Beveridge, R., Bowie, D. et al. (2001). What is new since the last (1999) Canadian Asthma Consensus Guidelines? *Canadian Respiratory Journal, 8*(Suppl A). 5A-27A.

The guideline development panel identified a need to provide a continuum of asthma care recommendations within RNAO nursing best practice guidelines. As a guideline on adult asthma had previously been developed, the panel utilized the framework already established to structure their development activities. This continuity allows for the transition of asthma care to be as smooth as possible for clients as they move from childhood to adulthood.

The panel members divided into subgroups to undergo specific activities using the short listed guidelines, other literature and documents for the purpose of drafting recommendations for nursing interventions. This process yielded a draft set of recommendations. The panel members as a whole reviewed the first draft of recommendations, discussed gaps, reviewed the evidence and came to consensus on a final draft set of recommendations.

This draft was submitted to a set of external stakeholders for review and feedback – an acknowledgement of these reviewers is provided at the front of this document. Stakeholders represented various health care professional groups, clients and families, as well as professional associations. External stakeholders were provided with specific questions for comment, as well as the opportunity to give overall feedback and general impressions. The results were compiled and reviewed by the development panel – discussion and consensus resulted in revisions to the draft document prior to dissemination.

Definition of Terms

For clinical terms not identified here, please refer to the Glossary of Terms, Appendix B.

Action Plan: A collaboratively written set of instructions that assists the client to adjust their asthma medication and/or to seek medical attention according to their level of symptoms and/or peak flow rate in order to maintain control.

Asthma: Asthma is characterized by paroxysmal or persistent symptoms such as dyspnea, chest tightness, wheezing, sputum production and cough associated with variable airflow limitation and a variable degree on airway hyper-responsiveness to triggers. Inflammation and its resultant effects on airway structure are considered the main mechanisms leading to the development and maintenance of asthma (Boulet et al., 1999, 2001).

Asthma Management: Establishing and maintaining control of a person's asthma includes education, environmental control measures, appropriate medications, action plans and regular follow-up care.

Certified Asthma Educator: The national certification for asthma educators in Canada, which ensures a common set of technical and teaching competencies. There are two integral aspects of education included in the Certified Asthma Educators certification: up-to-date knowledge about asthma, and educational theory and process.

Children: For the purposes of this guideline, the word child or children will be used to refer to individual(s) from birth to 18 years of age.

Clinical Practice Guidelines or Best Practice Guidelines: Systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical (practice) circumstances (Field & Lohr, 1990).

Consensus: A process for making policy decisions, not a scientific method for creating new knowledge. At its best, consensus development merely makes the best use of available information, be that scientific data or the collective wisdom of the participants (Black et al., 1999).

Control of Asthma: Acceptable asthma control is defined by the following parameters: use of inhaled short-acting ß2-agonist <4 times/week (excluding one dose/day for exercise); experience of daytime asthma symptoms < 4 times/week; experience of night-time asthma symptoms <1 time/week; normal physical activity level; no absence from work or school; and infrequent and mild exacerbations.

Delivery Device: An overall term used to describe a collection of devices used to deliver medications into the airways. Examples of delivery devices include metered dose inhalers, dry powder inhalers and nebulizers.

Developmental Age: A measure of a child's development (in body size or motor skill or psychological function) expressed in terms of age norms. Developmental age may be different than chronological age.

Education Recommendations: Statements of educational requirements and educational approaches/strategies for the introduction, implementation and sustainability of the best practice guideline.

Meta-analysis: Results from several studies, identified in a systematic review, are combined and summarized quantitatively.

Self-efficacy: Refers to the individual's belief that some behaviour or action will lead to a specific outcome and that he or she can actually perform the required action. The stronger the self-efficacy a person has, the more resilience that person has under stress, and the more effort he or she will put forth to accomplish goals (Kerr, 2003).

Organization and Policy Recommendations: Statements of conditions required for a practice setting that enables the successful implementation of the best practice guideline. The conditions for success are largely the responsibility of the organization, although they may have implications for policy at a broader government or societal level.

Practice Recommendations: Statements of best practice directed at the practice of health care professionals that are ideally evidence-based.

Background Context

Prevalence of Asthma

Asthma is the most common chronic illness affecting children (Aligne & Stoddard, 1997; Brownson et al., 1992; Dekker, Dales, Bartlett, Brunekreff, & Zwanenburg, 1991). Asthma affects 2.3 million Canadians over the age of 4 years (Statistics Canada, 2000) with an estimated total cost of between $504 million and $648 million in 1991 (Krahn et al., 1996). It accounts for more missed school days and limitations in daily activities than any other childhood illness (Harrison & Pearson, 1993; Ogborn, Duggan, & DeAngelis, 1994; Taylor & Newachek, 1992; Winkelstein, Tarizan, & Wood, 1997).

In Ontario, 10 to 13 % of children from birth to 18 years have asthma (Lava et al., 1998). Asthma is one of the main reasons children are admitted to hospital and is also one of the main reasons children are seen repeatedly in the emergency department. According to the latest statistics, almost 1 million Ontarians aged 4 years and older have been diagnosed with asthma (Statistics Canada, 2000). Despite advances in knowledge, medicine and technology designed to manage asthma, this represents a significant increase in the prevalence of asthma in Ontario in recent years – from 7.4% of those aged 4 and older in 1994/95 to 8.9% in 1998/99 (Statistics Canada, 2000).

Although most people with asthma can lead a symptom-free life, many do not. Many underestimate the severity of their asthma and continue to restrict their everyday activities, suffer needlessly, and perhaps die unnecessarily. Proper asthma management can lead to better asthma control and may reduce the incidence of death from asthma by as much as 80% (Institute for Clinical Evaluative Sciences in Ontario, 1996).

What Is Asthma?

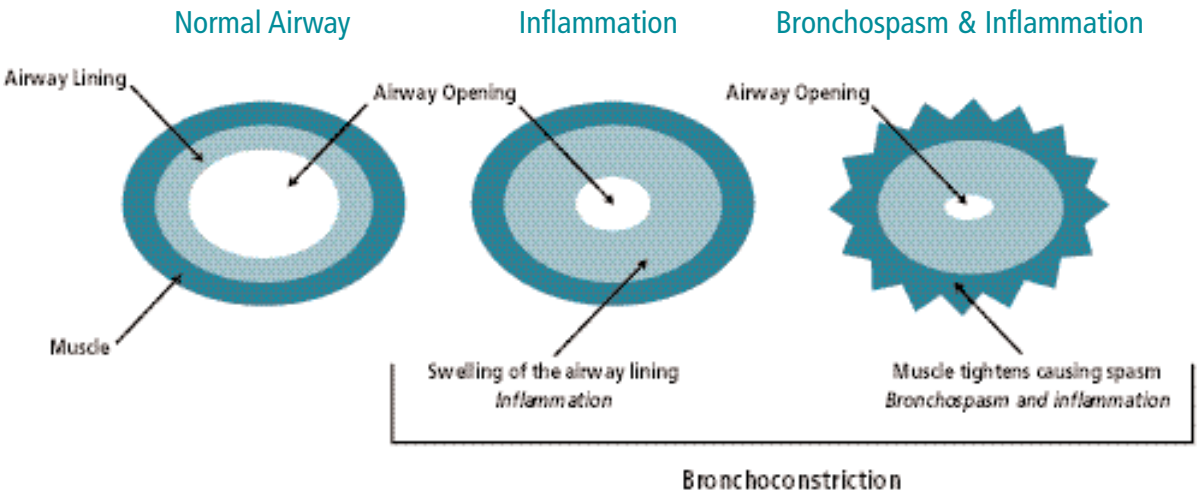
Asthma, a chronic inflammatory disorder of the airways, is characterized by paroxysmal or persistent symptoms such as dyspnea, chest tightness, wheezing, sputum production and cough associated with variable airflow limitation and a variable degree of airway hyper-responsiveness to triggers. Inflammation and its resultant effects on airway structure are considered the main mechanisms leading to the development and maintenance of asthma (Boulet et al., 1999, 2001). Asthma may be classified as mild, moderate or severe.

An asthma episode may begin suddenly, or may have a slow onset with a gradual worsening of symptoms. These episodes, which can last for a few minutes to several days, are attributed to a hyper-responsiveness of the airways and are typically reversible (Lung Association, 2000). The basic physiology of asthma is depicted in Figure 1. On the left is the opening of a normal

airway. When the individual with asthma is exposed to certain triggers that they are sensitive to, the airway narrows. This narrowing develops in one or two ways:

- The airway becomes swollen and plugged with mucous (inflamed), thus making the airway opening considerably smaller. This is depicted in the middle picture. This inflammation can last from a few hours to a few days.
- The muscles in the walls of the airway tighten and go into spasm (bronchoconstriction). The picture on the right demonstrates this process.

Figure 1: Basic Physiology of Asthma
Cross section of an airway.



Potentially, any loss of asthma control can be life threatening. Regardless of the severity of asthma, the severity of an asthma episode can range from mild to life threatening. Infants and young children are at a high risk for an asthma exacerbation if they experience asthma symptoms that require symptomatic treatment more than two times per week.

The goal of asthma management is to control or prevent the inflammation and to provide quick relief of symptoms by relaxing the muscles of the airways thereby reducing bronchoconstriction. Components of asthma management include achieving optimal asthma control through education, environmental control measures, appropriate medications, action plans and regular follow-up care.

Key points

- Asthma is a chronic inflammatory disorder of the airways.
- Typical symptoms include shortness of breath, chest tightness, wheezing, and/or coughing (especially night time cough).
- The severity of an asthma episode can range from mild to life-threatening and last from minutes to days.
- Airflow limitation in asthma is reversible.
- The goal of asthma management is to control or prevent inflammation, and to provide quick relief of symptoms by relaxing the muscles of the airway.

Establishing a diagnosis

Infants and young children with a diagnosis of atopic dermatitis, parental history of asthma, a diagnosis of allergic rhinitis, and wheezing apart from colds are at higher risk of developing asthma (Barbee & Murphy, 1998; GINA, 2002; Stone, 2003). Establishing a diagnosis of asthma is sometimes difficult in infants and young children. In older children, objective measures can be used to diagnose asthma (i.e., spriometry, pulmonary function test, or methacholine challenge test). A diagnosis of asthma is considered when an infant or young child has had more than three episodes of wheezing lasting more than one day in the past year, nocturnal awakenings related to breathing difficulties, and who has a high risk of developing asthma. (Boulet et al., 1999).

What causes asthma?

Although the exact cause of asthma is not known, several predisposing factors have been implicated in its development. These include: atopy – a greater tendency to have allergic reactions to environmental allergens (Sporik et al., 1990); genetics – a family history of asthma and/or atopy (Larsen, 1992; Millar & Hill, 1998); and exposure to environmental tobacco smoke (Arshad, 1992; Cook & Strachan, 1997; Soyseth, Kongerud & Boe, 1995; Stoddard & Miller, 1995).

There are several triggers that may irritate the hypersensitive airways in people with asthma and provoke an asthma episode. Common triggers include:

a) Irritants such as:

- Tobacco smoke (BTS/SIGN, 2003; Boulet et al., 2001, 1999; Chilmonczyk, Salmun & Megathlin, 1993; GINA, 2002; Murray & Morrison, 1986; Murray & Morrison, 1989; NIH, 1997; NZGG, 2002; United States Environmental Protection Agency, 1992);
- Exercise[1] (American Academy of Allergy, Asthma, and Immunology, 1999; Boulet et al., 1999; GINA, 2002; NZGG, 2002);
- Weather changes (Bellomo et al.,1992; Egan, 1985; Packe, Archer, & Ayres, 1983; Salvaggio et al., 1970; Usetti et al., 1983; Virchow et al., 1988);
- Outdoor pollutants (Burnett et al., 1995; Cody, Weisel Birnbaun, & Lioy, 1992; Delfino, 1994; Hoek & Brunekreef, 1995; Pope, 1989; Pope, 1991; Rennick & Jarman, 1992; Roemer, Hock & Brunekreef, 1993; Schwartz, Slater, Larson, Pierson & Koenig., 1993); and
- Exposure to indoor chemicals (AAAAI, 1999).

b) Allergens such as:

- Dust mites (BTS/SIGN, 2003; Boulet et al., 2001; GINA, 2002; Kuehr et al., 1995; Marks et al., 1995; NZGG, 2002; Platts-Mills, Hayden, Chapman & Wilkins,1987);
- Pet dander (BTS/SIGN, 2003; Boulet et al., 2001; Gelber et al., 1993; Kuehr et al., 1995; Millar & Hill, 1998; NIH, 1997; NZGG, 2002; Pollart, 1989; Sears et al., 1993; Sporik et al., 1995; Strachan & Carey, 1995; Warner et al., 1990);
- Pollen (GINA, 2002; NZGG, 2002; Peat et al., 1993; Suphioglu et al., 1992);
- Moulds (GINA, 2002; Hide et al., 1994; Zacharasiewicz, Zidek, Haidinger et al., 1999);
- Cockroach allergen (Boulet et al., 2001; GINA, 2002; NIH, 1997; Rosenstreich et al., 1997); and
- Foods or food additives (Freedman, 1977; GINA, 2002; Lee, 1992; NZGG, 2002; Taylor, Sears & van Herwaarden, 1994).

c) Other factors that can trigger episodes and influence asthma severity:

- Upper respiratory/viral infections (Boulet et al., 1999; GINA, 2002; Lemanske, 1989; NIH, 1997; NZGG, 2002; Pattemore, Johnston & Bardin, 1992);
- Rhinitis/Sinusitis (Boulet et al., 1999; Corren, Adinoff, Buchmeir & Irvin, 1992; GINA, 2002: Watson, Becker & Simons, 1993);
- Gastroesophageal reflux (GINA, 2002; Irwin et al., 1989; NIH, 1997; Nelson, 1984);
- Sensitivity to aspirin and other nonsteroidal anti-inflammatory drugs (NSAIDS) (GINA, 2002; NIH, 1997; NZGG, 2002; Sampson, 1999; Settipane et al., 1995; Szczeklik & Stevenson, 1999); and
- Topical and systemic beta-blockers (GINA, 2002; NIH, 1997; Odeh, Olivern & Bassan, 1991; Schoene, Abuan, Ward & Beasley, 1984).

[1] Despite its potential to be a trigger, with proper warm-up, people with exercise-induced asthma should be able to engage in physical activity (Boulet et al., 1999).

Some individuals with asthma may react to only one trigger, others may react to several. Further, an individual's triggers may change over time (Ministry of Health and Long-Term Care, 2000). It is important for individuals with asthma to know their triggers and the appropriate steps to reduce exposure. However, addressing these and providing reduction strategies is beyond the scope of this guideline. For more details regarding trigger reduction, refer to Appendix K for educational resources.

Key points

- The most common asthma trigger in children is viral infection.
- Common asthma triggers include irritants and allergens.
- An individual's triggers may change over time.
- Allergic rhinitis, sinusitis or gastroesophageal reflux may aggravate asthma.

Impact of Asthma

Asthma is implicated in at least 155 deaths per year in Ontario (Ministry of Health and Long-Term Care, 2000). Although deaths among children and young adults are not common, in 1998 in Canada, 15 people between 0 – 24 years died as a result of asthma (Health Canada, 2001b). An Australian study reported that 45% of people who died from their asthma had been assessed as having a history of only mild or moderate asthma (Robertson, Rubinfeld & Bowes, 1990). Indeed, according to the Institute for Clinical Evaluative Sciences (ICES, 1996), most (80%) of asthma-related deaths could have been prevented with proper asthma management.

Key Points

- Asthma is implicated in 155 deaths per year in Ontario.
- Most asthma related deaths are preventable.

Impact of Poorly Controlled Asthma

Despite medical advances in understanding the disease and the availability of more effective medications, poorly controlled asthma is a significant problem. According to a 2000 national survey (Chapman et al., 2001), more than 6 in 10 individuals with asthma (62%) are poorly controlled – that is, they experienced at least two of the following: daytime symptoms, sleep disturbances, physical activity restrictions, asthma episodes, absenteeism from work or school, or excess use of rescue medication. Similar estimates have been reported for Ontario (Health Canada, 1998).

Our health care system is bearing a significant burden in terms of hospitalizations and emergency room visits as a result of poorly controlled asthma. According to the National Population Health Survey 1996-1997 (Statistics Canada, 2000), 18% of people with asthma have visited the emergency department at least once in the past year. In Ontario, 65,109 days spent in hospital were attributed to poorly controlled asthma, costing the health care system $44,432,300 (Statistics Canada, 2000). These costs do not factor in other direct costs of the illness, such as physician visits and costs of medications, nor indirect costs, such as disability, absence from school or work, costs related to premature deaths, and traveling expenses to and from hospital. Although total figures for Ontario have not been tabulated, a 1995/1996 study to assess the annual cost of asthma in adult clients in south central Ontario concluded that the unadjusted annual costs were $2,550 per client (Ungar, Coyte, Chapman & MacKeigan, 1998). Multiplying this estimate by approximately 1 million people with asthma in Ontario, it is estimated that over *2.5 billion dollars* per year is spent in Ontario on asthma management.

The burden of poorly controlled asthma for the individual is difficult to estimate since a significant number of cases may go unreported and/or undiagnosed. In Ontario, 31% of individuals with asthma reported missing school, work, and/or social functions due to their asthma (ICES, 1996). Even if the individual with asthma is able to attend work or school, ongoing symptoms or medication may alter concentration and performance (National Asthma Control Task Force, 2000).

Key points

- 6 in 10 individuals with asthma are poorly controlled.
- Annual costs in Ontario for asthma may be as high as 2.5 billion dollars per year.

Gaining Control Over Asthma

Reducing the burden of asthma requires a greater understanding of why the prevalence of poorly controlled asthma is so high. Despite a high prevalence of uncontrolled asthma, Chapman et al. (2001) noted that, most clients (91%) believe that their asthma is adequately controlled, while only 24% of those studied achieved disease control by meeting the six symptom-based criteria listed by the Canadian Asthma Consensus Report. One-half (48%) of patients with poorly controlled asthma who used inhaled steroids did not understand the role of inhaled steroids and one-third (32%) of patients with poorly controlled asthma who used short acting bronchodilators misunderstood the action of quick relief bronchodilators.

The study concluded that people with asthma have:

- Low expectations about their asthma control;
- A poor understanding of the role of various medications; and
- Learned to live with and tolerate symptoms and limitations that are generally avoidable.

In addition, the survey highlighted that physicians were no better than their clients with asthma regarding the perception of asthma control (Chapman et al., 2001).

Proper care of asthma including education, environmental control measures, appropriate medications, action plans and regular follow-up care leads to optimal asthma control, improved quality of life for individuals with asthma and reduces the burden of health care costs. Because nurses are in contact with clients with asthma in a multitude of settings, they are in a unique situation to promote asthma control, identify early indicators of poorly controlled asthma, positively influence self-care practices and facilitate the referral of individuals to community resources and specialized care.

Key Points

- Most individuals with asthma accept poorly controlled asthma as normal or do not recognize that their asthma is out of control.
- Many physicians are not aware when their patients' asthma is out of control.

Health Care Transition for Children with Asthma and their Families

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BACKGROUND

Health care transition is the purposeful, planned movement of adolescents and young adults with chronic medical conditions from a child-centred to an adult-oriented health care system. Within the asthma population, transition is achieved through a **health promotion** approach to education and care.

Nurses have an important role in nurturing and facilitating health promotion, however, decision making, which is an integral part of improving one's health, ultimately rests on the individual. The goals are to reduce dependency and to increase self-reliance, self-help, and individual responsibility for well being. Towards those goals, health care transition starts at the time of diagnosis and involves a gradual shift of responsibility from health care providers, to parents and then to the child/adolescent. The goal is an independent, healthy functioning adult.

HEALTH PROMOTION FRAMEWORK

Overview:

The World Health Organization (WHO) has defined health promotion as "the process of enabling people to increase control over and to improve their health" (WHO, 1986). Although health promotion is directed toward health in general, it has implications for health care professionals working with children who have acute and/or chronic diseases. The emphasis is on ENABLING individuals to act on their OWN behalf to improve their health.

For children, health promotion implies: (1) improving overall well-being at an early age and (2) improving children's health status as adults. For those reasons, part of the focus of educational efforts is on assisting children in the development of **beliefs and expectations** about health and illness management that will affect their future engagement in self-care and treatment regimes.

Obviously involving children is not an all or none phenomena; something that often needs to be reinforced with parents who are reluctant to give up control. Rather, it is a process that builds on the abilities of the child and is much like learning any self-care behaviour (e.g., brushing their teeth; getting dressed). There is a gradual shift from dependence to interdependence to independence using a **developmental perspective**.

Beliefs and Expectations:

Personal control and self-efficacy beliefs are essential to an individual's participation in self-care. They reflect motivational variables, skill factors and appraisal of outcomes. Without considering these beliefs in educational efforts, there will be no lasting impact.

Health Locus of Control refers to the degree to which the individual believes that health is under his or her control or self-action, is the result of some powerful other (e.g., a health care professional), or is the result of something beyond anyone's control such as fate, luck or

chance. When promoting health care behaviours, we want to foster internal locus of control to the greatest degree possible. Individuals who believe that managing their disease is within their control are more likely to cope effectively and are more likely to engage in any preventive and treatment measures they are taught.

Self-Efficacy is related to control beliefs. It refers to the individual's belief that some behaviour or action will lead to a specific outcome and that he or she can actually perform the required action. The stronger the self-efficacy a person has, the more resilience that person has under stress and the more effort he or she will put forth to accomplish goals.

Because personal control and self-efficacy beliefs tend to stabilize at about 10 years of age, it is important to involve children in their own self-care with respect to treatments as early as is possible. Early involvement helps to establish patterns that persist into adulthood.

Developmental Perspective:

Health habits are formed in childhood, nurtured in the family and by health care professionals. Early health care promotes life long positive health behaviours and attitudes. The developmental perspective looks at how people think and behave from birth through maturity. It determines a child's understanding and reactions to illness, the most effective forms of educational intervention, the amount and type of responsibility the child can assume, as well as the barriers that impede health care.

Children develop through stages as they acquire the more complex cognitive skills such as organizing, storing, recalling, connecting and abstracting information. The stages occur in a set sequence. A particular type of logic defines each stage. A child's actions and thoughts are bound by that underlying logic. Each stage is built on the stage before it, however, their understanding at the next stage is qualitatively different and much more sophisticated. It is not simply that adults have more knowledge. Age provides a gross parameter for understanding how and what children are thinking.

In developing a practical guide for increasing participation in care, Piaget's theory of cognitive development, Erikson's theory of social-emotional development, and research regarding the development of health and illness concepts were applied. Developmental theories are summarized in Appendix C., a practical guide appears in Appendix D.

TRANSITION GUIDANCE

Diagnosis:

Health care transition begins at diagnosis. A diagnosis of asthma typically occurs at pre-school age but may not be identified until older school age. During the initial teaching phase, parents are informed of the need to involve children early on in self-care with respect to his or her asthma and the gradual shift to independence. Strategies for transitions are introduced to families as early as possible to allow incorporation into their life-style and parenting style. Education during the follow-up visits should promote progression with the understanding that transition is not linear and the parent may need to resume some tasks when the child is no longer able to do them due to circumstances such as illness, or important social responsibilities interfering.

Early School Years:

During the early school years when the child begins going to school and changes in their previous health care schedules are required, this should be discussed with parents.

Mid School Years:

At this time, there are changes in maturity and a need for independence. As children express their need for independence, there may be challenges related to adherence and asthma management. Children, who have previously been learning about self-management, are now expected to apply these skills. These concepts should be discussed with both child and parents.

Mid Adolescence:

Adolescents may want to be seen on their own during health care visits, and expectations should be discussed with them. Refer to the RNAO Nursing Best Practice Guideline *Enhancing Healthy Adolescent Development (2002a)* for strategies to support working with adolescents.

Late Diagnosis:

Children who are diagnosed later (e.g., age eight) may not immediately engage in self-care. The first year following diagnosis is typically considered to be an adjustment year. Teaching for both parents and child is required. Following that year, the child should be brought quickly up to speed with respect to skills that they are able to perform.

Refer to Appendix C – Synthesis of Developmental Issues Concerning Health and Illness, and Appendix D – Development of Self-Care Behaviours Specific to Asthma Management, for additional details.

Practice Recommendations

Assessment of Asthma Control:

The overall aim of asthma management is to control airway inflammation, which is the underlying pathology of asthma. The specific goals of controlling asthma and the underlying airway inflammation include: symptom control (cough, wheeze, chest tightness and breathlessness) during the day, night and with exercise; the prevention of exacerbations; the achievement of best possible pulmonary function; and the identification of the least medication required with the fewest side effects. The Canadian Asthma Consensus Report (1999) defines optimal asthma control as the absence of respiratory symptoms and the need for rescue medication, as well as a normal pulmonary function. However, because optimal asthma control is not possible for all children with asthma, asthma control is assessed against the following parameters: symptoms during the day and night, the need for a reliever inhaler, ability to perform physical activity, exacerbations, absenteeism from school and work, and pulmonary function. These clinical parameters of asthma control are shared by many asthma guidelines (BTS/SIGN, 2003; GINA, 2002; NIH, 1997, 2002; SIGN, 1998;). The Canadian Asthma Consensus Report (1999) provides guidelines for 'acceptable asthma control' with specified cut points for assessment (Table 1). It is recommended that the nurse use these parameters and values when assessing the level of asthma control for any child thought to have asthma or suspected of having asthma. If any of the parameters exceed the described frequency/value, the child may have uncontrolled asthma and should be referred back to the physician for further evaluation of medical management.

On their own, the assessment of these parameters cannot confirm the diagnosis of asthma. It is acknowledged that making the diagnosis of asthma in young children (under five years) is difficult, partially due to the inability to measure lung function. There is often hesitance in labeling a young child with asthma when the diagnosis can't be confirmed. Several terms are used to indicate that asthma is suspected or very likely and include 'twitchy airways', 'reactive airways', 'reactive airway disease', 'super sensitive airways', 'wheezy bronchitis', and others. These terms are used until the diagnosis can be confirmed by lung function tests. Often in practice, there is confusion and uncertainty about the diagnosis of asthma. As a result, parents may provide a history that indicates suspicion of asthma. Parents may report that their child has 'twitchy airway' disease, 'reactive airway' disease, etc., or that there is a history of asthma medication use, all of which indicates a strong suspicion of asthma. Under these circumstances, it is acceptable for the nurse to assess the level of asthma control using the indicators previously described (Table 1). However, remember that this assessment does not confirm or dispute the diagnosis of asthma. If the assessment reveals that the child exceeds the parameters, then a referral to the physician is warranted for further assessment, evaluation and clarification of the diagnosis.

Table 1: Indicators of Acceptable Asthma Control

Parameter	Frequency/Value
Daytime symptoms	< 4 times/week
Night-time symptoms	< 1 time/week
Need for short-acting ß$_2$-agonist	< 4 times/week*
Physical activity	Normal for age
Exacerbations	Mild, infrequent
Work/school absence	None
FEV_1 or PEF rate	> 90% personal best
PEF diurnal variation	< 10-15% variation

*Apart from one dose/day before exercise.

FEV_1: Forced expiratory volume in 1 second; PEF: Peak expiratory flow

[Adapted from Canadian Asthma Consensus Guidelines – Update, 2001] (see Boulet et al, 1999)

Recommendation • 1.0

All children identified or suspected of having asthma, will have their level of control determined by the nurse. *(Level IV)*

Recommendation • 1.1

During a nursing assessment of respiratory health, every child should be screened to identify those most likely to be affected by asthma.

- **Have you ever been told you have (your child has) asthma?**
- **Have you (has your child) ever used a puffer/inhaler or any type of medication for breathing problems? Have you experienced any improvement with these medications?** *(Level IV)*

Recommendation • 1.2

If a child is identified as, or suspected of having asthma, the level of control should be assessed based on:**

- **short-acting ß$_2$-agonist use**
- **daytime symptoms**
- **night-time symptoms**
- **physical activity**
- **absence from school/work**
- **exacerbations** *(Level IV)*

**If suspected of having asthma, further evaluation by a physician is required.

Recommendation • 1.3

For children identified as potentially having uncontrolled asthma, the level of acuity needs to be assessed by the nurse and an appropriate medical referral provided (i.e., urgent care or follow-up appointment). *(Level IV)*

Indicators for Assessment of Acuity

Before children can receive appropriate treatment for uncontrolled asthma, it is essential to assess accurately the severity of their symptoms. The following clinical indicators should be assessed and documented:

- Accessory muscle use – Look for the presence of indrawing; subcostal or intercostal muscle retractions (see Figure 2).
- Dyspnea – The impression of the nurse that the child is breathless or having a difficult time breathing such as too breathless to complete a sentence or to feed.
- Increased respiratory rate when child is afebrile.
- Cerebral function – The child may display increased agitation or a decreased level of consciousness.
- Lung function for children 5 years and older – If possible, objective lung function measurements should be determined by spirometry (Forced Expiratory Volume in one second) or peak expiratory flow rates. A value < 50% requires medical attention.
- Decrease in oxygen saturation – If a pulse oximeter is available, the level of oxygen saturation should be determined. An acceptable level of oxygen saturation is >92%.

If the child exhibits any of the above symptoms, they should be referred for immediate medical attention. Refer to Appendix E for asthma severity criteria by age.

If urgent medical consultation is required:

- Seek immediate medical attention.
- If within a medical facility, immediately notify medical personnel.
- Record vital signs at regular intervals, every 5-15 minutes or when there is a change in child's status.
- Do not allow the child to exert him/herself.
- Protect child's face from cold air.
- Document all areas of assessment, medications taken (drug, doses, route and times), and complications on the patient care report. (Health Canada, 2001a).
- Continue to closely monitor the child's condition and response to treatment including serial measurements of lung function and oximetry, if technology is available.
- Repeated administration of rapid-acting inhaled $ß_2$-agonists (2 to 4 puffs every 15-20 minutes for first hour) may be provided (GINA, 2002). Inhaled $ß_2$-agonists produce the most rapid relief from acute bronchospasm with the fewest side effects (Rossing, Fanta, & McFadden, 1983; College of Physicians and Surgeons of Manitoba, 2000).

Discussion of Evidence

Children with asthma often have poorly controlled disease that results in a decreased quality of life with significant interruptions in daily activities (Glaxo Wellcome, 2000). Therefore, the level of asthma control needs to be assessed frequently and treatment adjusted accordingly.

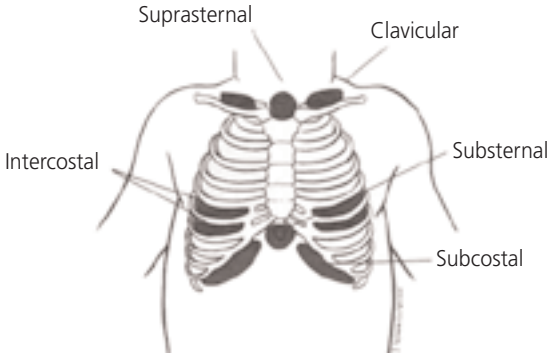
Children with asthma may experience a variety of symptoms, none of which are specific for asthma: wheeze, shortness of breath, chest tightness, cough (BTS/SIGN, 2003; GINA, 2002; NIH, 1997). The hallmark of asthma is that these symptoms tend to be variable, intermittent, worse at night and provoked by triggers such as colds/virus and exercise. Children with asthma present a spectrum of known signs and symptoms of asthma that vary in degree and severity from child to child as well as within an individual child over time (NIH, 2002). Once a child is identified as having asthma, a carefully administered questionnaire is a sensitive method for assessing a child's asthma control, past and present (Boulet et al., 1999; GINA, 2002). A history should be obtained from both the child and caregiver when possible (Boulet et al., 1999; Guyatt et al., 1997).

Asthma control is assessed using the parameters and cut-points outlined in Table 1 (Boulet et al., 1999, 2001). See Appendix E for individual questions to assess the level of asthma control

and a flow-chart of the process. Day-time symptoms such as cough, wheeze and chest tightness are assessed for frequency. Although wheeze is often associated with asthma (McFadden, 1973), cough may be the sole presenting manifestation of asthma in children (Corrao, Braman & Irwin, 1979). The presence of symptoms at night or early in the morning is an especially useful indicator and is often reported as night-time cough (GINA, 2002). For most children, exercise induced asthma is an expression of poorly controlled asthma and may be noted as a change or limitation in physical activity (BTS/SIGN, 2003). It is important to note that people who died as a result of asthma were four times more likely than controls to have reported daily ß$_2$-agonist use and night/early morning symptoms over the previous year (Hessel et al., 1999). Typically individuals who have died from asthma have experienced uncontrolled asthma for some time prior to the development of the fatal attack. It is key that nurses ensure that children and/or their care providers know how to determine the level of asthma control and when to seek medical attention in the event of worsening asthma (BTS/SIGN, 2003).

For children identified as potentially having uncontrolled asthma, the level of acuity needs to be assessed by the nurse. Respiratory failure is often preceded by a "compensated" state, in which the child is able to maintain adequate gas exchange at the expense of an increase in the work of breathing. Signs of respiratory distress characterize this compensated state. The child needs to be assessed for severity of symptoms and the need for medical assistance. An evaluation of the child's status and the severity of the exacerbation should include: the degree of breathlessness, as demonstrated by ability to complete a sentence or feed (GINA, 2002; SIGN, 1999) and use of accessory muscles (see Figure 2) (Kerem et al, 1991; McFadden, Kiser & Degroot, 1973). The literature suggests that the presence of accessory muscle use and dyspnea is associated with more severe airway obstruction. These signs become the most crucial signs to assess in settings where lung function and oxygen saturation measures are not available (Kerem et al, 1991). Another indicator of respiratory compromise is an increase in respiratory rate (Cohen, Zagelbaum, Gross, Roussos & Macklem, 1982; SIGN, 1999).

Figure 2: Areas where retractions are found



When the child's respiratory system is no longer able to compensate, gas exchange will deteriorate and oxygen saturation will drop below 92 % (GINA, 2002; Geelhoed, Landau, & Le Souef,1994), there may be presence of cyanosis (Rebuck, Braude & Chapman, 1982), and a decreased level of consciousness /or increased agitation (Rebuck, Braude & Chapman, 1982).

Objective lung function tests (spirometry) are more reliable for assessing the degree of airflow obstruction than findings from a physical examination. Clinical signs often correlate poorly with the severity of obstruction. Some children with acute severe asthma do not appear distressed. When possible, interview and physical assessments should be supplemented by objective measures of airflow, such as peak expiratory flow (PEF) or forced expiratory volume in one second (FEV_1) (see Appendix F) (BTS/SIGN, 2003; Boulet et al., 1999; Shim & Williams, 1980). Typically, children under the age of 5-6 years are not able to perform pulmonary function measurements accurately.

When assessing the severity of an asthma exacerbation, keep in mind that those with a higher risk for asthma-related death are those with a history of near fatal asthma requiring intubation (Turner, et al., 1998; Williams, 1980), those who have required hospitalization or emergency care for asthma in the past year, or those currently using or have recently stopped using oral steroids (Boulet et al., 1999; GINA, 2002). If any of these conditions exist, the child's severity should be judged as being more urgent than those without these conditions (BTS/SIGN, 2003).

Medications:

Asthma medications are one intervention used to help control asthma in children. It is important however to recognize that medications are not to be used as a substitute for proper control of environmental factors, as persistent exposure to inflammatory triggers will require higher doses of medication to control asthma symptoms (Philatanakul, 2003; Spahn & Szefler, 1998). A stepwise approach to pharmacological management is recommended as this approach aims to control symptoms quickly by starting treatment at an appropriate level for the child's current disease severity (BTS/SIGN, 2003).

Frequently, people with asthma search for complementary therapies to treat their asthma. There is insufficient evidence demonstrating clinical benefit from such therapies as homeopathy, chiropractic, acupuncture, hypnosis and relaxation techniques, herbal medicine and Chinese, Japanese and Indian medicines (Huntley, White & Ernst, 2002, NIH 2002).

Follow-up is essential to be able to achieve and maintain control through continuing assessment and stepping up treatment as necessary and stepping down treatment when control is achieved. In order to make judgment about stepping medications up or down an assessment must be completed to check adherence to the management plan, check proper device technique and ensure the elimination of triggers (BTS/SIGN, 2003).

Dosing and device selection can affect drug delivery and deposition. Metabolism of medications may be faster in children (especially younger children) than adults. For example, beclomethasone has been shown to be metabolized 40% faster in children compared to adults (GINA, 2002). Therefore, higher doses of medications may be necessary in children to achieve the same effect in adults. In addition, nasal filtration may prevent approximately 67% of the medication reaching the lungs (worse when crying), therefore it is recommended that *children use a spacer with a mouthpiece as soon as the child is developmentally able, usually over the age of 5* (Chua et al., 1994). Finally, the use of a metered dose inhaler with spacer is preferred over the use of a nebulizer for all children of all ages at all levels of severity (Spahn & Szefler, 1998). However, the use of a nebulizer should be considered for those who do not respond to a MDI with spacer.

Recommendation • 2.0

Nurses will understand the pharmacology of medications used to treat asthma in children. *(Level IV)*

Knowledge of medications includes the following:

- Trade and generic names;
- Indications;
- Doses;
- Side effects;
- Mode of administration;
- Age appropriate delivery device; and
- Pharmacokinetics.

Refer to Appendix G for a summary of a variety of medications used in the management of children with asthma. This appendix does not include all generic and brand names of asthma medications available on the market today, but includes the majority of common and not-so-common medications for asthma management.

Recommendation • 2.1

Nurses will be able to discuss the two main categories of asthma medications (controllers and relievers) with the child and their family members/caregivers, tailoring information for the developmental age of the child. *(Level IV)*

Discussion of Evidence:

Relievers

Relievers are medications that are used on an "as needed basis" to relieve asthma symptoms by relaxing the smooth muscle surrounding the airways and prevent asthma symptoms prior to exposure to triggers or prior to exercise. They are mainly represented by short-acting ß$_2$-agonists (e.g., salbutamol, terbutaline). Relievers are to be used at the lowest dose and frequency required to relieve symptoms. Refer to Appendix G for a discussion of relievers.

Short-acting ß$_2$-agonists

- Rapid onset of action (within 1-2 minutes).
- Children who need a short-acting ß$_2$-agonist several times a day (see assessment of control – Appendix E) require urgent reassessment with a view to increasing anti-inflammatory therapy (Boulet et al., 2001).
- There have been reported associations between overuse of inhaled ß$_2$-agonists and increased death or near death from asthma. Therefore, when daily use of short-acting inhaled ß$_2$ -agonist is needed other than once per day for exercise induced symptoms, a controller (anti-inflammatory medication) is required (Boulet et al, 1999).
- Salbutamol oral liquid is *not recommended* for infants with acute asthma. It produces an increase in adverse effects, especially tremulousness and wakefulness (BTS/SIGN, 2003; Johnson, Wieseman & Anderson, 2003)

Anticholinergic

- Atrovent (ipratropium bromide) is *not recommended as first line therapy* but may be used as a reliever when short-acting ß$_2$-agonists are not well tolerated due to side effects (Boulet et al., 1999). It is less effective than short-acting ß$_2$-agonists in relieving symptoms and has a limited role in paediatric asthma (Spahn & Szefler, 1998).
- Atrovent in addition to ß$_2$-agonist is safe and effective during the first 2 hours of a severe acute asthma exacerbation (Boulet et al., 2001; BTS/SIGN, 2003)

Emergency Administration

- For emergency situations ß$_2$-agonists should be administered by inhalations and titrated using objective and clinical measures of airflow obstruction as guides (Boulet et al., 1999). It is recommended that nurses be familiar with their agency's policy or medical directive in relation to emergency administration of asthma medication.
- Recommended dosage (which varies with age, weight and institution) for acute management is:
  - 2 to 4 puffs every 15-20 minutes in most cases of acute asthma, or 0.03 ml/kg nebulized salbutamol (max. 1 ml/dose) (BTS/SIGN, 2003);
  - It may be necessary to increase the dose to 1 puff every 30-60 seconds (Boulet et al., 1999; Canadian Association of Emergency Physicians, 2000);
  - Once maximum relief is achieved, continued administration of bronchodilators by any route is not likely to provide further clinical benefit and may result in toxic effects (Boulet et al., 1999).

Key Points

Relievers:

- A reliever should be used on an as needed basis for relief of symptoms
- Best represented by short-acting ß$_2$-agonists
- Act by relaxing the smooth muscle surrounding the airways
- Provide quick relief (within 1-2 minutes)
- Using 4 or more doses (2 puffs/dose) per week (excluding pre-exercise) is an indicator of poor control.

Teaching Tips for Nurses:

- Ask how often the reliever is used on a daily/weekly basis. Other than pre-exercise, relievers should only be used for symptoms.
- During an asthma exacerbation, coach parents to have their child re-assessed if they are requiring a reliever more than every 4 hours or the reliever is not effective.

Controllers (Preventers)

Controllers are medications that are taken regularly on a daily basis in order to minimize or prevent asthma symptoms and prevent exacerbations. Controllers are best represented by corticosteroids (inhaled and oral) that decrease inflammation, mucous and edema of the airways and are considered the single most effective therapy for control of inflammation in asthma (Hogan & Wilson, 2003). They are slow acting and need to be taken regularly every day even when feeling well. As well, early initiation of treatment with inhaled corticosteroids in the natural history of the disease is associated with better functional outcome (Barnes & Pedersen, 1993). Refer to Appendix G for a discussion of controllers.

First Line Controllers

Corticosteroids (Inhaled)

- Inhaled route is the preferred method of delivery.
- Inhaled steroids are recommended as the mainstay of treatment for persistent asthma in children, except for those whose disease is so mild that they only require infrequent, as-needed ß$_2$-agonist treatment (Boulet et al., 2001).

Dosing

- Initial daily dose in children is 200-1000µg (Boulet et al., 1999), 200-400µg (GINA, 2002, BTS/SIGN, 2003); higher doses of inhaled or the addition of oral or systemic corticosteroids may be required if the asthma is more severe (Boulet et al., 1999).
- When asthma is out of control, it should be treated as soon as possible to prevent a severe exacerbation. When asthma has exacerbated, a 4-fold increase in inhaled corticosteroids or the addition of oral prednisone has shown to be effective in decreasing the severity and duration of the exacerbation in children (Foresi, et al., 2000).

Corticosteroids (Systemic)

- Used in short bursts for asthma exacerbations.
- Used longer term for severe persistent asthma not responding to usual first line therapy.
- Less side effects with low dose alternate day dosing (Murray & Nadel, 2000)
- Refer to Recommendation 2.4 and Appendix G for a list of potential side effects.

Second Line Controllers

Leukiotriene Antagonists

- Are used in conjunction with inhaled corticosteroids and are not to be used as first line medication for asthma in children (Ducharme & Hicks, 2000).
- No evidence of effectiveness in wheezing infants.
- Does not prove to be effective in all children.

Long-Acting ß$_2$-agonists (LABA)

- When additional therapy is required, long-acting ß$_2$-agonists (salmeterol and formoterol) are the primary choice, versus theophylline or ipratropium bromide (Boulet et al., 1999).
- LABA's assist corticosteroids in achieving and maintaining asthma control and are not recommended for use in the absence of inhaled anti-inflammatory therapy.
- Deaths have been reported when given as monotherapy (Hogan & Wilson, 2003; SMART, 2003).
- LABA's are *not recommended* for relief of acute symptoms (Boulet et al., 1999), although recently, the long-acting ß$_2$-agonist Oxeze® (formoterol) has been approved for relief of acute bronchoconstriction in children ≥ 12 years of age.
- Regular treatment with LABA's may produce short-acting ß$_2$-agonist subsensitivity, an effect partially prevented by a bolus of high dose inhaled or systemic corticosteroid (Grove & Lipworth, 1995).

Third Line Controllers

Theophylline

- No evidence that aminophylline is of benefit for mild to moderate asthma and side effects are common (Boulet et al., 1999).
- May have steroid sparing effects.
- Therapy should only be attempted in children with severe or steroid dependent asthma.
- Serum levels need to be monitored regularly.

Sodium Cromoglycate/Nedocromil

- Non-steroidal anti-inflammatory controller medications that have an inconvenient dosing frequency.
- Sodium cromoglycate is ineffective in children (Tasche, Uijen, Bernsen, de Jongste & van Der Wouden, 2000).
- Nedocromil is of benefit in 5-12 year olds (Spooner, Saunders & Rowe, 2000).

Key Points

Controllers:

- Inhaled corticosteroids are the main treatment for control of asthma.
- Other medications are used as adjuncts when control is not achieved with an adequate dose of inhaled corticosteroids.
- Controllers must be taken regularly long-term to prevent or decrease inflammation and edema of the airways.
- Slow onset of action.
- The management goal for children should always be the lowest dose of inhaled corticosteroids necessary to control symptoms, therefore medication dose needs to be assessed regularly and reduced or discontinued when appropriate.

Teaching Tips for Nurses:

- Emphasize to parents that inhaled corticosteroids need to be taken on a regular/daily basis long-term to be effective, even when the child seems well.
- Advise children/parents that controller medication should not be decreased or stopped unless advised by a physician.

Recommendation • 2.2

All children with asthma should have their inhaler/device technique assessed by the nurse at each visit to ensure accurate use, as well as appropriateness of device for the developmental level of the child. Children with sub-optimal technique will be coached in proper device use or switched to a more appropriate delivery device. *(Level Ib)*

Discussion of Evidence:

Educating children in inhaler technique and reinforcing understanding of asthma medications can improve asthma management. Regular review of the delivery device is beneficial, as this helps to identify changing needs of the child as they grow and develop (National Institute for Clinical Excellence, 2002). Less than optimal use of a delivery device or inappropriate delivery device for the age/development of the child can impact the efficacy of medications and consequently have a negative impact on asthma control.

Delivery of inhaled medication by metered dose inhaler is dependent on the cooperation and coordination of the child. It is estimated that 50% of "press and breathe" metered dose inhaler users have less than optimal technique. Some children (generally younger ones), may not reliably generate inspiratory flows high enough for effective delivery of dry powder inhalers. Many children with asthma use their inhaler device incorrectly, even after comprehensive initial instruction. Instruction related to inhaler use should be given repeatedly to achieve and maintain correct inhalation technique in asthmatic children (Kamps, Brand & Roorda, 2002; Kamps, van Ewijk, Roorda & Brand, 2000).

Spacers should be used to deliver metered dose inhaler medication in all children with asthma, as this decreases the amount of coordination required, improves the deposition into the lower airways which improves medication efficacy, and minimizes the risk for systemic absorption of steroids therefore minimizing potential adverse effects.

In addition, infant behaviour during inhalation can have a significant impact on drug deposition in the lungs and on the resulting clinical effect. For example, nasal filtration may prevent approximately 67% of the medication from reaching the lungs which becomes worse when crying. It is therefore recommended that children use a spacer with a mouth piece as soon as they are developmentally able (Chua et al., 1994; Clarke, Aston & Silverman, 1993).

Refer to Appendix H for detailed descriptions of device techniques.

Key Points

- All children, of any age, should use a spacer device to deliver metered dose inhaled medication.
- Ask for a demonstration of technique at each patient contact.
- Ensure the most appropriate device is used for each child. Children should use a spacer with a mouth piece as soon as they are developmentally able and can breathe though their mouth without breathing through the nose (usually at 4 to 5 years of age).

Recommendation • 2.3

Nurses will be able to assess for potential barriers to asthma management. The nurse will be able to offer strategies to meet families' needs and support them in overcoming issues leading to treatment failure. *Level IV*

Discussion of Evidence:

Fewer than 50% of patients with asthma take their medication as prescribed (Stoloff, 2000). Device use may be influenced by a range of factors, including convenience, cost, ease of device use, portability, the stigma of having asthma, and personal or peer preference for a specific device. The relative importance of these factors changes as children get older. In particular, adolescents are at high risk for uncontrolled asthma due to a "quick fix" mentality, which leads them to not wanting to take maintenance medications (Spahn & Szefler, 1998).

Side effects from inhaled corticosteroids are usually a concern for children and families of children with asthma. Low doses of inhaled steroids (<400µg/day) are generally limited to topical side effects such as thrush, sore throat and, rarely, hoarse voice. The following is a list of systemic side effects that may occur at doses ≥400µg/day and the available evidence associated with each side effect in children (≥ 5 yrs of age) with asthma (Hogan & Wilson, 2003).

Growth

- Short-term growth suppression has been documented and is dose dependent (Kelly et al., 2003). However, it does not prevent children from attaining their normal adult height (Kelly et al., 2003; NIH, 2002).

Adrenal Suppression

- Less than 400µg/day is not generally associated with adrenal suppression. However, there have been isolated case reports of children with asthma treated with moderate to high doses of inhaled steroids experiencing suppression of the HPA axis (Boulet et al., 1999; Health Canada, 2003).

Bone Mineral Density (BMD)

- No decrease in BMD seen long-term on moderate doses of inhaled corticosteroids (Childhood Asthma Management Program Research Group, 2000; GINA, 2002).
- Higher doses (≥800µg/day) associated with a reduction in bone formation and degradation (NIH, 2002).
- Unlike adults, children are able to repair steroid-induced bone loss (Hansen & Nokkentued, 1989).
- Confounding variables should be taken into consideration when discussing BMD loss. The following have been found to contribute to reduced peak bone mass in children: some chronic diseases (uncontrolled asthma being one), delayed puberty, nutrition (decreased calcium intake), heredity and level of activity (GINA, 2002).

Cataracts

- No strong evidence showing inhaled steroids contribute to the development of cataracts in children. They are usually linked with oral steroid use in adults (Hogan & Wilson, 2003).

Key Points

- Children on oral or inhaled corticosteroids should have their height and weight documented at each visit to trend over time.
- Work with the family to create a management plan that is as simple as possible and that fits the lifestyle of the family.
- Assess for drug plan/drug coverage.
- Determine whether the family has resources to obtain the delivery device or suggest a less costly alternative (some insurance companies do not cover the cost of delivery devices).

Teaching Tips for Nurses:

- Set goals with the family regarding quality of life. Children with asthma should have the same quality of life as a non-asthmatic child.
- For parents concerned about the risks of inhaled steroids, advise that uncontrolled asthma may put their child at greater risk for poor linear growth.

Asthma Education:

Educating children and families to increase asthma knowledge and skills to maintain control of the disease is a long term commitment and an essential component of asthma therapy (Boulet et al., 1999). Asthma is variable and changes over time, therefore nurses need to assess and reinforce various aspects of asthma education regularly (BTS/SIGN, 2003; Boulet et al., 2001; GINA, 2002). As the needs of the child and family change, so must the education and teaching approaches in order to foster health care transitions (Boulet et al., 1999; BTS/SIGN, 2003; GINA, 2002; Ward et al, 2001).

Patient education is the mechanism through which children and their families learn to successfully manage their asthma. It is a powerful strategy to help individuals gain the motivation, skill and confidence to control their asthma (Feldman et al,1987; Mellins et al.,2000; NIH, 1997). Self-management education is designed to influence knowledge, management skills, behaviours and/or attitudes in order to empower children and caregivers in the overall management of their asthma.

Recommendation • 3.0

The nurse will provide asthma education, in collaboration with the health care team, as an essential part of care. *(Level Ia)*

Recommendation • 4.0

Child/family knowledge of asthma should be assessed by the nurse at each patient contact. Asthma education should be provided when knowledge and skill gaps are identified. *(Level Ia)*

Recommendation • 4.1

Tailor asthma education to the needs of the child and family by being developmentally appropriate, sensitive to cultural beliefs and practices and by using a variety of teaching methods (e.g., video, pamphlets, websites, group, role playing, problem solving). *(Level IV)*

Discussion of Evidence:

A systematic review of clinical trials (Wolf et al., 2003) found that asthma self-management education programs in children improve a wide range of measures of outcome. Conclusions about the relative effectiveness of the various components of educational programs are however, limited by the lack of direct comparisons. A systematic review and meta-analysis of controlled trials to determine the effectiveness of educational programs for asthma in children and adolescents found that self-management education improves lung function and feelings of self-control, reduces absenteeism from school, number of days with restricted activity, number of visits to the emergency department, and possibly the number of disturbed nights due to asthma symptoms (Guevara, et al., 2003). Educational programs directed to the prevention and management of asthma episodes should be a component of routine care for children with asthma. In addition, asthma self-management programs have been shown to be cost effective largely because they reduce a patient's use of health care resources (GINA, 2002).

A team approach should be used when nurses, pharmacists, respiratory therapists and other health care providers are available to support and expand patient education (Kotses et al. 1996; Mayo et al., 1990; NIH, 1997). Where possible, a coordinated education plan should be considered to facilitate communication between caregivers and continuity of care.

Using an individualized tailored approach is essential because it can result in improved asthma control (Boulet et al., 2001; GINA, 2002; Jones et al., 2001; Liu & Feekery, 2001). There are many variables that can influence how asthma education needs to be tailored, and therefore need to be highlighted.

Developmentally appropriate:

It is essential that nurses include the child in the educational interactions and provide developmentally appropriate interventions (AAAI, 1999; GINA, 2002; Holzheimer et al, 1998). Education for small children should be provided to the parents but children as young as 3 years of age can be taught simple management skills. Caregivers should be encouraged to allow the child to take age appropriate responsibilities for care, with increasing levels of responsibility for management as the child grows and develops (GINA, 2002). Researchers consistently have found that developmentally and age appropriate programs contribute to improved morbidity for the child and family (Evans et al, 2001; Madge et al, 1997; McGhan et al, 1998; Tieffenberg et al, 2000; Wilson et al, 1996). Tieffenberg et al. (2000) recognized that children respond to illness both cognitively and emotionally. Educational programs that used playing techniques rather then the passive transmission of information resulted in an increased sense of well being, and decreased parental anxiety. Family dynamics improved due to less school absenteeism, and a reduction in the number of attacks and emergency visits. Refer to Appendix C and D for details regarding developmental stages and asthma self-care behaviours.

Setting of care:

Another way education can be personalized is the contextual setting in which the education is occurring. Asthma education can be provided in all settings, however the specifics of what is delivered seems to vary depending on the setting. There have been no studies that explicitly compare the settings and the asthma education that is delivered. However, the setting does seem to influence the type of asthma education that is delivered (Partridge & Hill, 2000). For example, in the Emergency Room, there is usually little time to provide comprehensive asthma education. However, it is an important time to educate children and families, the child's asthma is poorly controlled and a parent and child's motivation may be higher. The primary goals of education in this setting include teaching "need to know" preventative action and directing patients to resources which can provide more detailed education (GINA, 2002; NIH, 1997). Similarly, children admitted to hospital may be particularly receptive to information and advice about their illness. There is an opportunity to review the child and family's understanding of the causes of asthma exacerbations, the purposes and correct uses of treatment and the actions to be taken for worsening asthma symptoms or peak flow values (NIH, 1997; Madge, McColl & Patton, 1997). In community settings, effective programs were found to be those

that include: promoting prevention of exacerbations; appropriate treatment by directing the public to health care facilities that are easily accessible; and education tailored to the needs of populations (Fisher et al., 1994).

Language and Culture:

Culture has a profound influence on individual and family health belief systems, illness management and help-seeking behaviour (Guruge, Lee & Hagey, 2001). Statistics Canada (2001) indicated that just under 24% of Ontarians reported a mother tongue other than English or French and 2% of all Ontarians spoke neither official language. An individual's explanatory model of illness is a combination of ethnocultural beliefs, personal and idiosyncratic beliefs, and biomedical concepts (Pachter, 1994). Therefore, the idea of health and the actions people take to maintain their health differ from one culture to another (Choudhry, 1998). Because cultures are so diverse, nurses cannot know all the specific aspects of each patient's culture and are at risk of making the assumption that all people of a given culture have common beliefs and health practices (Hines & Frate, 2000). Open discussion about the child and family's explanatory model for asthma will help to identify discrepancies between their beliefs and western health practices, offering the opportunity for negotiation and merging of treatment models if no conflict exists. If traditional health practices are thought to be harmful, or in conflict with the recommended medical regime, alternative health practices need to be negotiated with the child/family that fit with the individual's ethnocultural belief system (Guruge, Lee & Hagey, 2001; Guruge, 1996; Pachter, 1994; Kleinman, Eisenberg, & Good,1978). Educating the child and family as to the importance of following medically prescribed therapy in addition to, or as an extension of, traditional practices, will increase client satisfaction and reduce any conflict between self-management practices and the medically prescribed regime (Griffiths, et al. 2001; Pachter, 1994).

Diverse cultures also present with diverse primary languages. Inability to communicate in a common language is often sited as a primary barrier to accessing health services (George, 2001; Guruge, 1996). Language can also be a barrier to the negotiation process required in the development of a culturally acceptable plan of asthma care.

Literacy is another issue to consider when presenting written materials that support asthma self-management behaviour. Written materials need to be made available in the parent's language of literacy. School age children learn to speak and read English very quickly so translation of information targeted for the child is not essential unless the intent is for the parent to use the same material. During teaching sessions, professional interpreters should be utilized whenever possible to ensure adequate communication without the interference of bias or concern for confidentiality, both being issues that present with the use of family

members or friends (Dreger & Tremback, 2002). Nurses and their organizations are encouraged to support culturally sensitive care through improved knowledge of prevalent cultures' health practices, develop culturally appropriate assessment tools to identify needs and potential barriers to a culturally acceptable asthma management plan, and ensuring the availability of resources to support a culturally diverse practice. Refer to the College of Nurses of Ontario (2004) *Practice Guideline: Culturally Sensitive Care.*

Educational Strategies/Tools:

When delivering asthma education, it is important to provide a variety of interventions and educational strategies. Often, reading material is provided but little else. There is evidence that different interventions may lead to different outcomes, depending on the individual (Wolf et al., 2003). Therefore, a combination of methods should be used. Educational strategies such as individual teaching, small group sessions, computer games, checklists, video and audio tapes, workbooks and booklets, internet websites, problem solving sessions, and role playing are suggested (Boulet et al., 1999).

Key Points

- Education is a key strategy to help children/families gain the motivation, skill and confidence to control asthma.
- A team approach to education should be used.
- Education should be:
  - tailored to the individual;
  - developmentally appropriate;
  - appropriate for the setting; and
  - sensitive to cultural beliefs/values.
- A variety of interventions and educational strategies should be used.

Education Framework:

Recommendation • 5.0

The nurse can use a structured framework to provide basic asthma education to build both the child's and family's knowledge of asthma and self-management skills. A partnership between the nurse, child and family is important to engage the child and family in an interactive educational process. *(Level IV)*

Framework for Basic Asthma Education

Knowledge

- ❑ Normal versus asthmatic airways
- ❑ What happens to the airways during an asthma attack
- ❑ Signs and symptoms of worsening asthma
- ❑ Identification of triggers
- ❑ Medications
  - ❑ Role of relievers and controllers
  - ❑ Action
  - ❑ Potential side effects
  - ❑ Importance of adherence

Self-Management Skills

- ❑ Medications
  - ■ Use of age appropriate delivery device
  - ■ Child/family demonstration of delivery device technique
  - ■ Proper inspection/cleaning of device
- ❑ Self Monitoring
  - ■ Use of symptom diary/Peak Expiratory Flow (PEF) monitoring and technique (optional)
- ❑ Action Plan
  - ■ Description of action plan
  - ■ How to use an action plan
  - ■ Steps to take in worsening asthma
  - ■ Emphasize long term benefits
  - ■ Encourage family to share the action plan with all relevant caregivers such as grandparents, older children, daycare workers, teachers, coaches, camp counselors, nurses etc.

Refer to Appendix K for resources for child and family education.

Discussion of Evidence:

Asthma education has changed in the past ten years, likely due to the advances in understanding the pathophysiology of asthma, the screening methods, the diagnosis and innovative pharmacological therapies. These new understandings and methods of treatment have enabled individuals to be active participants in management of their asthma (Velser-Fredrich & Srof, 2000). In the past, the goal of asthma education was to improve knowledge. However, by

today's standards, asthma education that looks only at increasing knowledge has little effect on building self management skills and does not necessarily lead to positive asthma control outcomes. Using behavioural approaches to build and maintain asthma management skills is essential (Boulet et al., 1999; Osman, 1996). Knowledge provides a basic foundation for self-management skills, however knowledge and the goal of skill building must always be coupled and is directly related to self-efficacy. Refer to Appendix I for a list of resources related to a behavioural approach to education.

Consensus among researchers and asthma experts reveals that there are certain specific components of an education program that are necessary for positive outcomes in basic asthma education. These components include: normal versus asthmatic airways; what happens to airways during an attack; identification of triggers; how controller and reliever medications work; symptoms of worsening asthma; and skills associated with self-management which include inhalation technique, self-monitoring, and action plans. The positive outcomes that have been reported include: decreased hospital admissions, decreased morbidity, increased knowledge, decreased emergency room visits, decreased school absences, improved quality of life, and decreased parental anxiety (AAAI, 1999; Boulet et al., 1999/2001; BTS/SIGN, 2002; Gebert et al, 1998; GINA, 2002; Liu & Feekery, 2001; NIH, 1997; Partridge & Hill, 2000; Wolf et al, 2003).

No empirical evidence has been established in determining which skills and/or educational components have the greatest impact on outcomes in asthma education. It is challenging to study due to variability from person to person and the ethical limitations in withholding certain information (Partridge & Hill, 2000).

Key Points

- Education should utilize a behavioural approach and should emphasize increased knowledge in order to build and maintain asthma self-management skills.

Action Plans:

Recommendation • 6.0

All children should have an individualized asthma action plan for guided self-management, based on the evaluation of symptoms, with or without peak flow measurements, developed in partnership with a health care professional. *(Level Ia)*

Recommendation • 6.1

The action plan must be reviewed and reinforced in partnership with the parent/caregiver, child and health care professional during every contact. The nurse will coach the parent to act as an advocate for their child, ensuring that the action plan is implemented and kept up to date. *(Level Ia)*

Discussion of Evidence

The Canadian Asthma Consensus Guidelines (1999), along with other national and international guidelines, recommend that every individual with asthma be provided with a written asthma action plan (Boulet et al., 1999; NIH, 1997, SIGN, 1998). It is the role of the nurse to facilitate the attainment and effective use of an individualized action plan, developed in partnership with the physician and the rest of the asthma care team.

This self-management tool should include strategies for the prevention and management of asthma episodes, and be incorporated into routine asthma care for children and adolescents (Wolf et al., 2003). For some individuals, focusing on the long-term treatment goals may improve adherence (Mellins et al., 2000; NIH, 1997).

Educational programs, incorporating written action plans, for the self-management of asthma in children and adolescents were associated with modest to moderate improvement in many outcome measures, including lung function, self-efficacy, absenteeism from school, number of days of restricted activity, number of visits to an emergency department and possibly nights disturbed by asthma. Programs with strategies based on peak flow measurements showed the strongest effects on morbidity outcomes, as did programs with interventions aimed at the individual (Guevara, Wolf, Grum, & Clark, 2003)

Peak Flow Monitoring

Most children over 6 years of age can use PEF monitoring. It can be an important clinical tool, useful especially with children presenting with persistent asthma or with children who are poor perceivers of their airway obstruction (GINA, 2002). It important to note that PEF monitoring is effort dependant, with potential for incorrect readings related to poor technique, misinterpretation or device failure (NIH, 2002). Predicted peak flows are determined by height, age and sex, and are usually recommended by each individual Peak Flow Meter manufacturer. However, common peak flow rates are included in Appendix F as examples.

During initial visit or follow-up consultation, the concept of peak expiratory flow monitoring should be considered depending on the child's age (developmental and chronological), ability and clinical need. Patients, especially those with more than mild disease, should receive training in how to measure and record PEF. When patients are taught how to record and interpret their PEF, it is helpful to explain that in addition to the absolute value of peak expiratory flow, its variability is important. A variability of 20% or more between daytime and night-time readings (diurnal variation) indicates poor asthma control. The child and family should understand that such monitoring is undertaken to check the effectiveness of therapy and to give early warning of potential deterioration. It may be helpful to stress that PEF monitoring is not done merely for the health care professional's record, but rather provides critical information for making decisions about treatment, and thus PEF monitoring is a tool for patients to help themselves (GINA, 2002). Refer to Appendix F for use of a Peak Flow Meter. Refer to Appendix J for an example of a symptom diary.

Key Points

- Every child with asthma should have a written asthma action plan.
- Action plans have been shown to improve certain outcome measures.
- PEF monitoring can be used in most children over the age of 6, however PEF is effort dependent with potential for incorrect readings related to poor technique, misinterpretation, or device failure.

Referral and Follow-up:

Regular follow-up care and referral is essential for achieving and maintaining control of asthma in children. Nurses working with children diagnosed with asthma and their families need to be aware of the importance of regular follow-up care and referral, if needed, to attain and maintain control of asthma.

Recommendation• 7.0

The nurse should facilitate follow-up assessments and education to achieve and maintain control of asthma for the child diagnosed with asthma. *(Level Ia)*

Recommendation • 7.1

The nurse will determine the child's primary asthma management provider by asking "who do you see for your asthma management?" *(Level IV)*

Recommendation • 7.2

Nurses should advocate for a referral to an asthma specialist (respirologist, allergist, paediatrician, Certified Asthma Educator etc.) for the following: frequent visits to the emergency department; poor understanding of asthma self-management; symptoms are not responding to usual treatment; and/or uncertainty of diagnosis. *(Level IV)*

Recommendation •7.3

Nurses should advocate for referral to an asthma education program and/or link to community resources, if available. *(Level IV)*

Discussion of Evidence

Children with asthma and their families need regular supervision and support by health care professionals who are knowledgeable about the condition. Continual monitoring is critical to assure that therapeutic goals are met (GINA, 2002). A systematic review of clinical trials supports the conclusion that routine asthma care for children and their families should include self-management education interventions (Wolf et al., 2003). Health care professionals need to work with the child and family to regularly monitor and review the asthma action plan, medications and device technique, as well as the level of asthma control. Such routine clinical care is associated with a reduction in missed school or work days, a reduced exacerbation rate and generally improved symptom control (BTS/SIGN, 2003; Boulet et al., 1999; GINA, 2002; ICSI, 2002; NIH 1997). The frequency of regular follow-up care will be dependent on the level of control achieved – more frequent follow-up is generally required until acceptable control is achieved and at transition through developmental stages. In order to ensure that the child and family have access to regular follow-up care, the nurse is in a prime position to assess for a primary health care professional who is available to fulfill this role.

In certain situations, a referral to an asthma specialist should be considered and advocated for on behalf of the child and family. These situations include, but are not limited to, the following: frequent visits to the emergency department, poor understanding of asthma self-management, symptoms are not responding to treatment, and uncertainty of diagnosis (BTS/SIGN, 2003; Boulet et al., 1999; GINA, 2002; ICSI, 2002; NIH, 1997).

Referrals to asthma education programs or community resources should be offered to all children and families, if they are locally available. These resources may include asthma clinics, community support groups, telephone support lines, and school/community asthma programs. Refer to Appendix K for suggested resources in the community.

Education Recommendations

Recommendation • 8.0

Nurses working with children with asthma must have the appropriate knowledge and skills to:

- **Identify the level of asthma control;**
- **Provide basic developmentally appropriate asthma education; and**
- **Identify the need for follow-up with primary care provider and/or community resources.**

(Level IV)

Specific areas of knowledge and skills include the following:

- Assessment of asthma control (Appendix E);
- Effective teaching and communication strategies (Appendix I);
- Assessment for gaps in knowledge and skills;
- Basic components of asthma education;
- Developmental stages (Appendix C and D);
- Asthma medications (Appendix G);
- Inhaler/Device techniques (Appendix H);
- Available community resources (Appendix K)

Discussion of Evidence:

Children with asthma need regular supervision and support by health care professionals who are knowledgeable about asthma and its management (BTS/SIGN, 2003; Boulet et al., 1999; GINA, 2002; NZGG, 2002). In order to provide the necessary support and education to children with asthma and their families, nurses who are not specialists in asthma care require basic skills in these identified areas. Education of health care providers about asthma best practices should address the knowledge, skill and attitudes necessary to implement the guideline recommendations (NZGG, 2002).

All health care professionals working with children with asthma require basic education, which should include: the content of the clinical practice guidelines; information about asthma; prevention of exacerbations; training in guided self-management; ability to recognize deteriorating asthma; knowledge about medications; training in the proper use of medication delivery devices and peak flow meters. Several studies have shown that health care professionals do not consistently demonstrate correct use of inhaler devices (Hanania, Wittman, Kesten & Chapman, 1994; Interiano & Guntupalli, 1993) and lack basic skills with these devices.

Education for health care professionals should emphasize the importance of preventive management. In addition, health care professionals need to recognize that patient education involves giving information and acquisition of skills, as well as behaviour change on the part of the child and their family. This component of education requires strong communication skills on the part of the provider (GINA, 2002).

Organization & Policy Recommendations

Although there are cost and resource implications associated with the implementation of the best practice guideline *Promoting Asthma Control in Children*, the evidence suggests that the longer term outcomes of promoting asthma control may be beneficial both from the perspective of health benefits achieved for the child and family, and health care system cost benefits resulting from a reduction in emergency health care use and more appropriate use of health care human resources (McGhan et al., 1998; Partridge & Hill, 2000; Schermer et al., 2002).

Adherence to national asthma guidelines is often poor (Cicutto, 2000; Partridge & Hill, 2000, Scarfone, Zorc, & Capraro, 2001). The successful implementation of guidelines requires the careful application of sound change management principles. This should begin with official endorsement by the organization (Graham, et al. 2002). The focus in the organizational and policy recommendations is on identifying those critical aspects of change management that have been suggested to be closely associated with the implementation of successful asthma programs for children and their families.

Recommendation • 9.0

Organizational leadership must maintain a commitment to best practice guideline implementation. *(Level IV)*

Recommendation • 9.1

Organizations must maintain a commitment to sustain the healthy working environment required to support guideline implementation such as:

- **A critical mass of nurses educated and supported in guideline implementation;**
- **Care delivery systems and adequate staffing that support the nurses' ability to implement these guidelines; and**
- **A sustained commitment to evidence-based practice in paediatric asthma care.**

(Level IV)

Recommendation • 9.2

Organizations must promote a collaborative practice model within a multidisciplinary team to enhance asthma care. This approach must include all health care professionals and community caregivers involved with the child. *(Level IV)*

Recommendation • 9.3

Organizations need to plan and provide appropriate material resources to implement these best practice guidelines. Specifically, they must have:

- **Placebos and spacer devices for teaching;**
- **Sample templates for action plans;**
- **Educational materials;**
- **Documentation tools;**
- **Resources for child/family and nurse education; and**
- **Peak flow or other monitoring equipment, when indicated.**

(Level IV)

Recommendation • 9.4

Organizations are encouraged to develop key indicators and outcome measurements that will allow them to monitor the implementation of the guidelines, the impact of these guidelines on optimizing quality patient care, as well as any efficiencies, or cost effectiveness achieved. *(Level IV)*

Recommendation • 10.0

Nursing best practice guidelines can be successfully implemented only where there are adequate planning, resources, organizational and administrative support, as well as appropriate facilitation. Organizations may wish to develop a plan for implementation that includes:

- **An assessment of organizational readiness and barriers to education.**
- **Involvement of all members (whether in a direct or indirect supportive function) who will contribute to the implementation process.**
- **Dedication of a qualified individual to provide the support needed for the education and implementation process.**
- **Ongoing opportunities for discussion and education to reinforce the importance of best practices.**
- **Opportunities for reflection on personal and organizational experience in implementing guidelines.**

In this regard, RNAO (through a panel of nurses, researchers and administrators) has developed the *Toolkit: Implementation of Clinical Practice Guidelines* based on available evidence, theoretical perspectives and consensus. The *Toolkit* is recommended for guiding the implementation of the RNAO guideline *Promoting Asthma Control in Children.* *(Level IV)*

Recommendation • 11.0

Government agencies responsible for the allocation of funding must recognize the critical role of a seamless continuum of care in promoting asthma control in children. This must include recognition and funding for the following:

- **Health promotion activities provided by Public Health Nurses in such venues as schools;**
- **Acute care provided by nurses as part of health care teams in hospitals and community physician offices; and**
- **Long-term care, provided by community health nurses in family homes.**

(Level IV)

Recommendation • 12.0

Nurses should seek opportunities to advocate for the promotion of optimal asthma care for children and families affected by asthma.

(Level IV)

Discussion of Evidence:

Organizational Commitment

A critical initial step in the implementation of guidelines must be the formal adoption of the guidelines. For example, the organization may consider formally incorporating the recommendations to be adopted into their policy and procedure structure (Graham, Harrison, Brouwers, Davies, & Dunn, 2002). This initial step paves the way for general acceptance and integration of the guideline into such systems as the quality management process.

New initiatives such as the implementation of a best practice guideline require strong leadership from nurses who are able to transform the evidence-based recommendations into useful tools that will assist in directing practice. It is suggested that the RNAO *Toolkit* (2002) and opportunities for leadership development in facilitating change (e.g., RNAO Nursing Best Practice Champions Network) be considered to assist organizations develop the leadership required for successful implementation. Appendix L provides a description of the *Toolkit*.

In addition to human resources, organizations must also ensure that health care professionals involved in promoting asthma control in children work in an environment that allows them to practice according to the guidelines and have access to appropriate teaching tools, including developmentally appropriate educational materials, inhalers, and asthma monitoring devices. Organizations also need to develop processes regarding the availability of single patient use placebos and delivery devices, as there are no recognized protocols or guidelines on the most effective cleaning methods to minimize or prevent cross-infection (Clancy, 2003).

Evidence suggests that cooperation between health care providers, parents and children is essential to achieve optimal management (BTS/SIGN, 2003; Partridge & Hill, 2000; Ward 2001). Mellins et al. (2000) further suggest that when patients are involved in setting their own health care goals, and when the health care team then links interventions with progression toward those goals, learning is enhanced.

A commitment to monitoring the impact of the implementation of the *Promoting Control of Asthma in Children* best practice guideline is a key step that must not be omitted if there is to be an evaluation of the impact of the efforts associated with implementation. It is suggested that each recommendation to be adopted be described in measurable terms and that the health care team be involved in the evaluation and quality monitoring processes. A suggested list of evaluation indicators can be found in the following section of the guideline.

Implementation strategies

Organizations must consider ensuring the acquisition of the resources needed not only to implement, but also to sustain, practice that is based on the guideline recommendations. Partridge and Hill (2000) suggest the following key findings from systematic reviews that address guideline implementation in clinical areas other than asthma care:

- Application of the guideline to the characteristics of the local community and setting;
- An initial, specific educationally based strategy should be used to implement the guideline;
- Consideration to amending commonly utilized education and documentation tools to include cues that assist in implementation of the recommendations should be made;
- Outreach by an expert or implementation leader directly to practicing clinicians is suggested to impact the success of implementation and maintenance;
- Multiple strategies for implementation are more likely to produce the desired change in clinical practice, including continuing education, ongoing feedback about benchmarks achieved and/or quality indicators monitored (BTS/SIGN, 2003); and
- Target barriers to adapting the guideline, including work load and administrative support for change.

Advocacy

There are many different settings in which asthma education and care can occur, including hospital emergency rooms and wards, primary care offices and/or clinics, schools, and at home. Research in each of these settings has suggested benefits and challenges associated with each area of practice. Assuming that individuals, including children and their parents, have preferences about learning, it is recommended that nurses take on an advocacy role in supporting the need for health care dollars to be spent on supporting asthma education to be done in multiple settings and venues. Asthma education "should be available at every interface between patients and care providers, whatever the setting" (Partridge & Hill, 2000, p. 336).

Evaluation/Monitoring of Guideline

Organizations implementing the recommendations in this nursing best practice guideline are recommended to consider how the implementation and its impact will be monitored and evaluated. The following table, based on a framework outlined in the RNAO *Toolkit: Implementation of Clinical Practice Guidelines (2002b)* illustrates some indicators for monitoring and evaluation:

Level of Indicator	Structure	Process	Outcome
	• To evaluate the supports available in the organization that allow for nurses to promote control of asthma.	• To evaluate changes in practice that lead towards improved control of asthma.	• To evaluate the impact of implementing the recommendations.
Organization	• Availability of patient education resources (sample action plans, referral information) that are developmentally appropriate and consistent with guideline recommendations. • Asthma care availability across the organization, e.g. # asthma education programs and their location and focus • Access to placebos (MDIs, Turbuhaler, Diskus), holding chambers and peak flow meters for patient education. • Review of guideline recommendations by organizational committee(s) responsible for policies or procedures. • Availability of, and access to, asthma specialists.	• A standardized tool is used to assess asthma control.	• Policies and procedures related to assessing asthma control are consistent with the guidelines.

Nurse	• Availability of educational opportunities re: promoting asthma control within the organization.
	• Number of nurses attending educational sessions re: promoting asthma control.
		• Level of asthma control assessed, including:
		  • inhaled short acting ß2 use;
		  • night-time awakenings;
		  • daytime symptoms;
		  • interruption with daily activities.
		• Nurses' self-assessed knowledge of:
		  • Two main categories of asthma medication
		  • Correct inhaler technique
		  • Asthma action plans
		• Nurses' self-reported awareness levels of community referral sources for children with asthma and linking child/family to existing asthma resources in the community.
			• Evidence of documentation in child's record consistent with guideline recommendations regarding:
			  • Assessment of asthma control;
			  • Assessment of inhaler technique;
			  • Review of action plan;
			  • Referral to asthma educator, asthma clinic or other community resource;
			  • Provision of asthma education.

Level of Indicator	Structure	Process	Outcome
Patient		• Percent of children/families reporting an assessment of their asthma control. • Percent of children/families reporting a review of their action plan with the nurse (for those who do not have an action plan, the nurse should explain the purpose of an action plan and provide a sample of an action plan). • Percent of children/families reporting that a nurse asked them to demonstrate the use of their inhaler.	• Percent of children with acceptable asthma control. • Percent of children with action plans. • Percent of children/families judged to have satisfactory device technique. • Percent of children presenting to ER or admitted to hospital in one year with asthma related symptoms. • Child/family satisfaction with their asthma health care team. • Child/family knowledge/ developmentally appropriate involvement of the child in his/her own care.
Financial Costs	• Provision of adequate financial and human resources for guideline implementation.		

An evaluation focusing on reviewing existing evaluation measures, identifying gaps and developing new tools has been designed to support the evaluation of the implementation of guideline recommendations. These tools will be published on the RNAO website at www.rnao.org/bestpractices as they become available.

Implementation Tips

The Registered Nurses Association of Ontario, the guideline development panel and evaluation team have compiled a list of implementation tips to assist health care organizations or health care providers who are interested in implementing this guideline. A summary of these strategies follows:

- Have a dedicated person such as an advanced practice nurse or a clinical resource nurse who will provide support, clinical expertise and leadership. The individual should also have good interpersonal, facilitation and project management skills.
- Establish a steering committee that is comprised of key stakeholders and members who are committed to leading the initiative. Keep a work plan to track activities, responsibilities and timelines.
- Provide educational sessions and ongoing support for implementation. The education sessions may consist of presentations, facilitator's guide, handouts, and case studies. Binders, posters and pocket cards may be used as ongoing reminders of the training.

Plan education sessions that are interactive, include problem solving, address issues of immediate concern and offer practice of new skills (Davies & Edwards, 2004).

- Provide organizational support such as having the structures in place to facilitate the implementation. For example, hiring replacement staff so participants will not be distracted by concerns about work and having an organizational policy that reflects the value of best practices through policies and procedures. Develop new assessment and documentation tools (Davies & Edwards, 2004).
- Identify and support designated best practice champions on each unit to promote and support implementation. Celebrate milestones and achievements, acknowledging work well done (Davies & Edwards, 2004).

In addition to the tips mentioned above, the RNAO has developed resources that are available on the website. A *Toolkit* for implementing guidelines can be helpful if used appropriately. A brief description about this *Toolkit* can be found in Appendix L.

Process For Update / Review of Guideline

The Registered Nurses Association of Ontario proposes to update the Best Practice Guidelines as follows:

1. Each nursing best practice guideline will be reviewed by a team of specialists (Review Team) in the topic area every three years following the last set of revisions.

2. During the three-year period between development and revision, RNAO Nursing Best Practice Guidelines project staff will regularly monitor for new systematic reviews and randomized controlled trials (RCT) in the field.

3. Based on the results of the monitor, project staff will recommend an earlier revision period. Appropriate consultation with a team of members comprised of original panel members and other specialists in the field will help inform the decision to review and revise the guideline earlier than the three-year milestone.

4. Three months prior to the three year review milestone, the project staff will commence the planning of the review process by:
   a) Inviting specialists in the field to participate in the Review team. The Review Team will be comprised of members from the original panel as well as other recommended specialists.
   b) Compiling feedback received, questions encountered during the dissemination phase as well as other comments and experiences of implementation sites.
   c) Compiling new clinical practice guidelines in the field, systematic reviews, meta-analysis papers, technical reviews and randomized controlled trial research, and other relevant literature.
   d) Developing detailed work plan with target dates and deliverables.

The revised guideline will undergo dissemination based on established structures and processes.

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Appendix A: Search Strategy for Existing Evidence

STEP 1 – DATABASE Search

A database search for existing asthma guidelines was conducted by a university health sciences library. An initial search of the Medline, Embase and CINAHL databases for guidelines and articles published from January 1, 1995 to November 2002 was conducted using the following search terms: "asthma", "asthma education", "self-care", "self management", "paediatric asthma" "pediatric asthma", "practice guideline(s)", "clinical practice guideline(s)", "standards", "consensus statement(s)", "consensus", "evidence-based guidelines" and "best practice guidelines".

STEP 2 – Structured Website Search

One individual searched an established list of web sites for content related to the topic area. This list of sites, reviewed and updated in October 2002, was compiled based on existing knowledge of evidence-based practice websites, known guideline developers, and recommendations from the literature. Presence or absence of guidelines was noted for each site searched as well as date searched. The websites at times did not house a guideline but directed to another web site or source for guideline retrieval. Guidelines were either downloaded if full versions were available or were ordered by phone/email.

- Agency for Healthcare Research and Quality: http://www.ahcpr.gov
- Alberta Heritage Foundation for Medical Research-Health Technology Assessment: http://www.ahfmr.ab.ca//hta
- Alberta Medical Association – Clinical Practice Guidelines: http://www.albertadoctors.org
- American College of Chest Physicians: http://www.chestnet.org/guidelines
- American Medical Association: http://www.ama-assn.org
- British Medical Journal – Clinical Evidence: http://www.clinicalevidence.com/ceweb/conditions/index.jsp
- Canadian Coordinating Office for Health Technology Assessment: http://www.ccohta.ca
- Canadian Task Force on Preventive Health Care: http://www.ctfphc.org
- Centers for Disease Control and Prevention: http://www.cdc.gov
- Centre for Evidence-Based Mental Health: http://cebmh.com
- Centre for Evidence-Based Pharmacotherapy: http://www.aston.ac.uk/lhs/teaching/pharmacy/cebp
- Centre for Health Evidence: http://www.cche.net/che/home.asp
- Centre for Health Services and Policy Research: http://www.chspr.ubc.ca

- Clinical Resource Efficiency Support Team (CREST): http://www.crestni.org.uk
- CMA Infobase: Clinical Practice Guidelines: http://mdm.ca/cpgsnew/cpgs/index.asp
- Cochrane Database of Systematic Reviews: http://www.update-software.com/cochrane
- Database of Abstracts of Reviews of Effectiveness: http://nhscrd.york.ac.uk/darehp.htm
- Evidence-based On-Call: http://www.eboncall.org
- Government of British Columbia – Ministry of Health Services: http://www.hlth.gov.bc.ca/msp/protoguides/index.html
- Institute for Clinical Systems Improvement: http://www.icsi.org/index.asp
- Institute of Child Health: http://www.ich.ucl.ac.uk/ich
- Joanna Briggs Institute: http://www.joannabriggs.edu.au/about/home.php
- Medic8.com: http://www.medic8.com/ClinicalGuidelines.htm
- Medscape Women's Health: http://www.medscape.com/womenshealthhome
- Monash University Centre for Clinical Effectiveness: http://www.med.monash.edu.au/healthservices/cce/evidence
- National Guideline Clearinghouse: http://www.guidelines.gov
- National Institute for Clinical Excellence: http://www.nice.org.uk
- National Library of Medicine Health Services/Technology Assessment: http://hstat.nlm.nih.gov/hq/Hquest/screen/HquestHome/s/64139
- Netting the Evidence: A ScHARR Introduction to Evidence-Based Practice on the Internet: http://www.shef.ac.uk/scharr/ir/netting
- New Zealand Guidelines Group: http://www.nzgg.org.nz
- NHS Centre for Reviews and Dissemination: http://www.york.ac.uk/inst/crd
- NHS Nursing & Midwifery Practice Development Unit: http://www.nmpdu.org
- NHS R & D Health Technology Assessment Programme: http://www.hta.nhsweb.nhs.uk/htapubs.htm
- PEDro: The Physiotherapy Evidence Database: http://www.pedro.fhs.usyd.edu.au/index.html
- Queen's University at Kingston: http://post.queensu.ca/~bhc/gim/cpgs.html
- Royal College of General Practitioners: http://www.rcgp.org.uk
- Royal College of Nursing: http://www.rcn.org.uk/index.php
- Royal College of Physicians: http://www.rcplondon.ac.uk
- Sarah Cole Hirsh Institute: http://fpb.cwru.edu/HirshInstitute
- Scottish Intercollegiate Guidelines Network: http://www.sign.ac.uk
- Society of Obstetricians and Gynecologists of Canada Clinical Practice Guidelines: http://www.sogc.medical.org/sogcnet/index_e.shtml
- The Canadian Cochrane Network and Centre: http://cochrane.mcmaster.ca
- The Qualitative Report: http://www.nova.edu/ssss/QR

- Trent Research Information Access Gateway: http://www.shef.ac.uk/scharr/triage/TRIAGEindex.htm
- TRIP Database: http://www.tripdatabase.com
- U.S. Preventive Service Task Force: http://www.ahrq.gov/clinic/uspstfix.htm
- University of California, San Francisco: http://medicine.ucsf.edu/resources/guidelines/index.html
- University of Laval – Directory of Clinical Information Websites: http://132.203.128.28/medecine
- University of York – Centre for Evidence-Based Nursing: http://www.york.ac.uk/healthsciences/centres/evidence/cebn.htm

STEP 3 – Search Engine Web Search

A website search for existing asthma guidelines was conducted via the search engine "Google", using the search terms identified above. One individual conducted this search, noting the results of the search, the websites reviewed, date and a summary of the results. The search results were further critiqued by a second individual who identified guidelines and literature not previously retrieved.

STEP 4 – Hand Search/Panel Contributions

Additionally, panel members were already in possession of a few of the identified guidelines. In a rare instance, a guideline was identified by panel members and not found through the previous search strategies.

STEP 5 – Core Screening Criteria

The above search method revealed 18 guidelines, several systematic reviews and numerous articles related to paediatric asthma.

The final step in determining whether the clinical practice guideline would be critically appraised was to have two individuals screen the guidelines based on a series of inclusion criteria. These criteria were determined by panel consensus:

- Guideline is in English;
- Guideline dated no earlier than 1997;
- Guideline is strictly about the topic area;
- Guideline is evidence-based, e.g., containes references, description of evidence, sources of evidence; and
- Guideline is available and accessible for retrieval.

RESULTS OF THE SEARCH STRATEGY

The results of the search strategy and the decision to critically appraise identified guidelines are itemized below. Eight guidelines met the screening criteria and were critically appraised using the *Appraisal of Guidelines for Research and Evaluation* (AGREE Collaboration, 2001) instrument.

TITLE OF THE PRACTICE GUIDELINE RETRIEVED AND CRITICALLY APPRAISED
American Academy of Allergy, Asthma & Immunology (1999). Pediatric asthma: Promoting best practices. Guide for managing asthma in children. [On-line]. Available: www.aaaai.org/members/resources/initiatives/pediatricasthmaguidlines/default.stm
Boulet, L. et al. (1999). Canadian asthma consensus report: 1999. Canadian Medical Association [On-line]. Available: www.cmaj.ca/cgi/reprint/161/11_suppl_1/s1.pdf
British Thoracic Society and Scottish Intercollegiate Guidelines Network (2003). British Guideline on the Management of Asthma. [On-line]. Available: www.sign.ac.uk/guidelines/fulltext/63/index.html
Global Initiative for Asthma (2002). Global strategy for asthma management and prevention. [Online]. Available: www.ginasthma.org
Institute for Clinical Systems Improvement (2002). Health care guideline. Diagnosis and Management of Asthma. [On-line]. Available: www.ICSI.org
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Scottish Intercollegiate Guidelines Network (1998). Primary care management of asthma. Scottish Intercollegiate Guidelines Network.
Scottish Intercollegiate Guidelines Network (1999). Emergency management of acute asthma. Scottish Intercollegiate Guidelines Network.

Appendix B: Glossary of Terms

Agonist: A substance that mimics, stimulates or enhances the normal physiological response of the body.

Airway Remodeling: A collective term that encompasses the alterations in structural cells and tissues in the airways of some individuals with asthma which is believed to lead to largely irreversible airway limitations.

Allergen: A protein or non-protein substance that is capable of inducing an allergic reaction or hypersensitivity. Common allergens can include: house dust mites, house dust, animals, food, mould, and pollen.

Antagonist: A substance that inhibits the normal physiological response of the body.

Asthma Episode: A worsening of asthma symptoms, also referred to as an asthma attack, asthma exacerbation or asthma flare-up, in which the individual's asthma is out of control. May vary in severity from mild to life threatening.

Atopy: Development of an immunoglobulin E (IgE)-mediated response to common allergens.

ß2-agonist: A group of bronchodilators resulting in smooth muscle relaxation and bronchodilation through stimulation of $ß_2$ receptors found on airway smooth muscle.

Bronchoconstriction: A narrowing of the airway caused by bronchial smooth muscle contraction (tightening) and airway inflammation (swelling).

Bronchodilators: A category of medications that produce relaxation of the smooth muscles surrounding the bronchi, resulting in dilatation of the airways. See Relievers.

Controllers: Controllers are medications that are taken regularly on a daily basis to minimize asthma symptoms from occurring and prevent exacerbations. They may also be known as preventers.

Corticosteroids: A group of synthetic hormones that suppress the various inflammatory processes involved with asthma – currently the most effective maintenance therapy for most patients. See Controller.

Dry-Powder Inhaler (DPI): A breath activated device used to deliver medication in powder form to the lungs.

Forced Expiratory Volume in the first second in liters (FEV_1): The measure of the maximum volume of air a person can breathe out from the lungs in the first second of a forced expiratory manoeuvre. It is the most important measurement for following obstructive lung disease and determines the severity of airway obstruction. The normal value is ≥ 80% of the predicted value. See Spirometry

Holding Chamber: See Spacers

Hyperresponsiveness: The tendency of the smooth muscle of the airway to contract more intensely in response to a given stimulus/irritant than it does in a normal airway. This condition is present in virtually all symptomatic individuals with asthma. The most prominent manifestation of this smooth muscle contraction is airway narrowing.

Irritants: A class of triggers that are non-allergenic that can provoke asthma symptoms.

Leukotriene-Receptor Antagonists (LTRA): Non-steroidal anti-inflammatory that works by blocking the leukotriene receptors on cells involved in the inflammatory process.

Methacholine Challenge: A method of assessing airway responsiveness. In this test, an aerosol of one or more concentrations of methacholine is inhaled. Results of pulmonary function tests (e.g., spirometry) performed before and after the inhalations are used to determine response.

Metered Dose Inhaler (MDI): A hand activated device used for delivering an aerosolized medication to the lungs.

Metered Dose Inhaler, Chlorofluorocarbon Propelled – MDI(CFC): A metered dose inhaler using a chlorofluorocarbon as the propellant for aerosolization of medication.

Metered Dose Inhaler, Hydrofluoroalkane Propelled – MDI(HFA): A metered dose inhaler using a hydrofluoroalkane as the propellant for aerosolization of medication.

Nebulizer: A machine that aerosolizes medication, using either oxygen or compressed air. The resulting fine mist is inhaled from either a mask over the nose or a mouthpiece.

Peak Flow Meter (PFM): A portable device used to measure peak expiratory flow rate.

Peak Expiratory Flow in L/min (PEF): A measure of the maximum speed at which a person can forcefully expel air from the lungs following maximal inspiration. It provides a simple, quantitative and reproducible measure of the existence of airflow obstruction. The measurement is effort dependent.

Preventers: See Controllers.

Pulmonary Functions Test: See Spirometry.

Relievers: Relievers are medications that are used to relieve asthma symptoms and to prevent asthma symptoms prior to exercise, exposure to cold air or other triggers. See Bronchodilators; ß$_2$-agonists.

Spacers: A holding chamber device for aerosolized medication that attaches to metered dose inhalers to make it easier to use, and to deliver more medication to the lungs. They are available in various sizes, with and without masks.

Spirometry: A test that measures forced expiratory volumes and flow rates. See FEV_1.

Triggers: Factors that can provoke asthma symptoms. Every individual with asthma has a unique set of triggers for asthma symptoms. Triggers include both allergens and irritants.

Appendix C: Synthesis of Developmental Issues Concerning Health and Illness

Piagetian Concepts of Cognitive Development	Erikson's Social Emotional	Body Parts & Functioning	Health/Illness Concept	Cure	Instruction and Self-care Suggestions
Sensorimotor (age 0-2) • Know world by looking, grasping, mouthing • Develop thinking categories • Develop object permanence • Ability to follow simple verbal directions	Trust vs Mistrust (0-1.5)	• By 18 months, most can identify eyes, nose, mouth, fingers, toes, feet, hair when asked "show me your ..." • Number of items named increases dramatically between 18 & 24 months			• Timely responses to infants needs • Focus efforts on parent
Preoperational (ages 2-7) • Use of mental representations • Develop concepts and symbols (language) to communicate • Focus on here and now • Thinking limited to personal or immediate experience • Can only consider one aspect of a situation at a time • Limited notion of cause-effect • Difficulty classifying objects • Deferred imitation • Questioning through play • Exploration and mastery • Egocentric (limited ability to imagine alternative viewpoint) NB: When provided with concrete material and questions are asked pertaining to familiar experiences their thinking may be more logical	Autonomy vs Doubt (1.5-3) • Begin self-control Initiative vs Guilt (3-5) • Less dependent on parents • Sense of effectiveness and self-concept develops • Learn acceptable and unacceptable behaviour • Great curiosity Industry vs Inferiority (6-7) • Rudimentary conscious • Learn skills • Relationships shift to peers	• Focus is on the ability to name body parts • By age 3 or 4 children can identify many external body parts but have limited understanding of their internal structures • 5 and 6 year olds name bones, blood, and food or drink as internal structures • Many misconceptions regarding body functions	• Global, circular, magical thinking about health or illness or illness seen as a transgression of rules • Most see health as positive, doing desired activities • DO NOT RELATE HEALTH TO ILLNESS • Do not believe that one can be healthy and unhealthy at the same time • Do not rely on body cues to determine their own health status • Rely on others to tell them they are sick NB: UNABLE to understand processes and mechanisms	• Repeat statements likely said to them by an adult	(Ages 2-5) • Teach parents care giving and limit setting skills • Encourage child participation in taking treatments and medications (e.g., choosing a book during treatment, or drink to follow meds) • Demonstrate equipment on a doll and let them copy • May be able to learn that medicine and feeling good are associated (Ages 6-7) • Take medications and treatments correctly with reminders • Can learn internal signals • Create choice opportunities • Provide concise, honest, age-appropriate information • Use simple pictures to aid • Can learn about medicine

Piagetian Concepts of Cognitive Development	Erikson's Social Emotional	Body Parts & Functioning	Health/Illness Concept	Cure	Instruction and Self-care Suggestions
Concrete Operations (7-12) • Concrete thinking • Begin to think more logically and to consider cause and effect • Develop concepts of conservation (i.e., can consider original and changed state) and reversibility • Classify on several dimensions • Think through a chain of events (e.g., 1st, 2nd, 3rd) • Concern with here and now • Trial and error problem solving • 8-year olds understand concept of days of the week, and number of days which must pass before an event • 9-year olds tell time correctly	**Industry vs Inferiority** (ages 7-8) • Learn parents can be wrong • Avoid disapproval • Conform to group norms **(ages 8-9)** • Use rituals • Less dependent • See themselves in terms of labels (nice, mean) **(ages 9-10)** • Understand rules • Increased competition • Strong peer influence **(ages 11-12)** • Self-consciousness • Enjoys challenges • Eager to please	• Better ability to name internal organs • Most can correctly identify the function of a specific body part (e.g. lungs) when asked • Only 38% of 10 to 11 year olds recognize the interconnections of the organs into body systems • Many misconceptions	• Parrot-like responses, little comprehension • Enumeration of symptoms associated with illness • 9-10 year olds may be able to reverse from healthy to sick and back to healthy • Many believe illness is due to contamination • Some understand that causation is internal but have little understanding of the process • Do not think behaviour designed to improve future health is relevant to them • Unable to consider hypothetical results of present health options	• Able to specify a specific action to cure • Taking medicine is one possible action • Later in the stage, they perceive themselves as doing something to MAINTAIN health • Begin to understand that the body can heal itself	• Participation in self-direction of procedures • Teach about dose, times taken, indications for use, contraindications and side effects • Encourage responsibilities and chores • Can learn to take and record pulse if necessary • Use models/diagrams in teaching information
Formal Operations (age 12+) • Hypothetical-deductive reasoning emerges • Begin to explore logical solutions to concrete or abstract concepts • Later on, reason by analogy or metaphor • Systematically think about multiple possibilities • Project into the future • Recall past	**Identity vs Role Confusion** (age 13-14) • Self-consciousness, moody • Develops consistent morals • Worry about loss of identity • Want limits AND freedom **(ages 14-15)** • Peer belongingness important • Seek independence **(ages 16+)** • Principles of ethics • Consider career directions	• Knowledge of external and internal parts • Know much about how their bodies work and how they should be maintained	• Stability of health beliefs occurs around age 11 to 13 • Equate health and illness • May consider mental health • Internalization of the agent NB: A limited number understand the physiological processes/mechanisms involved	• Able to state how medicine may help, or how eating good food will help	**(Ages 13-15)** • Use models/diagrams in clarifying information • Practice or demonstrate independence skills and planning **(Age 16+)** • Use models/diagrams in clarifying information • Independent functioning • Can arrange for refill of prescribed medications when low • Can keep accurate records

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Appendix D: Development of Self-Care Behaviours Specific to Asthma Management

Cognitive Developmental Stages	Tasks for Parents and Children
Sensorimotor (age 0-2)	**Toddler:** Help hold the delivery device with mask Help clean the delivery device with mask Put the device in the box Can learn to take deep breaths Can pick a story to read after taking medication or select an activity Can hold a delivery device with mask on their favorite doll or toy **Parent:** Parent learns about and adjusts to diagnosis of asthma Learns asthma management
Preoperational (ages 2-7)	**Child (ages 2-4):** Can start to describe how they feel Can use a spacer (with the help of an adult) Recognize a few early warning signs **Parent:** Child may need reassurance that they are not being punished by being unwell **Child (ages 4-7)** Can use an inhaler if prescribed Can help assemble nebulizer treatments Recognize the names of medications Recognize some asthma triggers Should participate in activities that build stamina Able to learn what wheeze and tightness are

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Cognitive Developmental Stages	Tasks for Parents and Children
Concrete Operations (ages 7-12)	**Child (ages 7-8)** Can learn to use peak flow meters and to record readings Able to learn internal signs and symptoms and when to report to adult Can learn to use inhaled medications (with adult guidance) Can identify allergens, triggers and early warning signs Can take some responsibilities for remembering to take medications (with adult guidance) and for telling parents when medications are running low Able to learn what to do in case of an attack Should have a physical fitness plan that includes stamina building activities **Parent**: Coach child to communicate effectively with teachers about their physical concerns Parent/caregivers give support and assistance as necessary **Child (ages 8-12)** Able to participate in most asthma management activities Can learn to recognize early warning signs and to manage them Can learn names of medications, their purpose, side effect and timing Can assume some responsibility for remembering to take medication and for telling parents when medication is running low Can learn to use inhaled medication Can learn to clean and assemble equipment (with adult supervision) Can use peak flow meter and look after asthma diary Continued fitness plan **Parent:** Parent/caregivers give support and assistance as necessary Encourage parents to give children increased responsibility in communicating with health care providers about their asthma control.
Formal Operations (age 12+)	**Pre-teen:** Able to take responsibility for taking routine medications and for telling caregiver when medication is running low **Parent:** Parents/caregivers to take more of a supportive role as the child takes more responsibility for self-management. **Adolescent:** Independence in all aspects of care; learn to schedule medications to fit into lifestyle Often don't appreciate reminders from adults Should show judgment, i.e., having appropriate medications available at all times Shows awareness of emergency plan Accepts reinforcement of technique and additional information May wish to see health care provider on their own without parent present

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Appendix E: Assessing Asthma Control

Respiratory Screen to Identify those with Asthma

"Have you ever been told you have (your child has) asthma?" OR "Have you (has your child) ever used a puffer/inhaler or any type of medication for breathing problems?" "Have you experienced any improvement with these medications?"

YES → *Potential Asthma*

NO → *No further asthma assessment*

Assess Asthma Control

- Do you cough, wheeze, or have chest tightness 4 or more times per week?
- Do you wake up at night or in the morning with coughing, wheezing or chest tightness one or more times per week?
- Do you use your blue inhaler (reliever medicine) 4 or more times per week to relieve symptoms (chest tightness, wheeze, cough, dyspnea)? [excluding use for strenuous exercise]
- Have you changed and/or limited your physical activity because of symptoms (cough, wheeze, chest tightness, SOB) or fear of experiencing symptoms?

If answered NO to all questions, asthma is CONTROLLED

Assess Asthma Knowledge

Provide Education

If answered YES to one or more, Asthma may be UNCONTROLLED

Assess Asthma Severity *Urgent medical consultation if ANY of the following exist:*

Symptom	<2 years old	2 – 5 years old	>5 years old
Accessory muscle use	Intercostal, sternal and/or substernal retractions present		
Observed dyspnea	Marked respiratory distress, difficulty feeding, poor respiratory effort, grunting, nasal flaring, + / – oral cyanosis	Poor respiratory effort, distress (fatigue, exhaustion), too breathless to talk, dyspnea at rest, grunting, nasal flaring, + / -oral cyanosis	
Respiratory Rate	>60 / min and/or Apnea	> 40 / min	> 30 / min
Air entry on auscultation	Unequal – Decreased – Absent (silent chest)		
Cerebral function	Agitated, altered level of consciousness		
Bronchodilator Use	Response is not prompt or not sustained for 3 hours		
Peak flow	N/A	N/A	< 50% personal best or of normal values
Oxygen Saturation	< 92%		

YES to any of the above, Uncontrolled and Urgent Care required

Immediate Medical Assistance Required

Once stabilized, Provide Education

NO to all of the above, Uncontrolled and Non-urgent Care required

Provide Education

Refer to Physician

Content of Educational Program

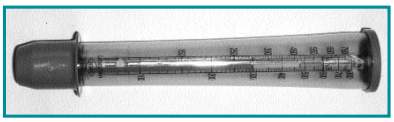
- Basic asthma facts
- Role/rationale for medications (relievers/controllers)
- Device technique
- Self-monitoring asthma control
- Action plan

Appendix F: Peak Flow Monitoring Tips

1. Monitoring Peak Expiratory Flow (PEF) may be useful in some children, particularly those children/caregivers who have difficulty perceiving airway obstruction.
2. Caution should be exercised in interpreting PEF results, as they are extremely effort dependent, and should be used in conjunction with other clinical findings. Most children cannot accurately perform this maneuver until 6 years of age due to the required physical coordination and the ability to follow instructions.
3. The child's PEF technique should be observed until the practitioner is satisfied that the technique produces accurate/reliable readings.
4. Home PEF should be linked to the level of symptoms in the action plan.
5. Children who are using a PEF meter should be instructed, with their caregivers, on how to establish their personal best PEF and use this value as the basis for their personalized action plan.
6. PEF devices must be checked regularly for accuracy and reproducibility of results. The child's peak flow meter should be inspected by a health care professional at least once a year, or any time there is a question about the validity of the readings. Values from the PEF meter should be compared with the values obtained from a spirometer.
7. Baseline morning and evening monitoring should be carried out over a number of weeks to assist with determining personal best values. Monitoring of PEF values should continue, however the frequency of measurements is adjusted to the needs of the child and the severity of the disease.
8. Children and their caregivers should be alerted to the significance of increased diurnal variation (evening to morning changes) in PEF. Variation in PEF values greater than 15 – 20% between evening and morning readings indicates poor asthma control.

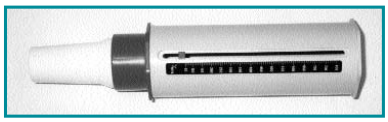
Examples of Peak Flow Meters

The selection of an appropriate PEF meter should be made in consultation with the child/family and primary care provider, pharmacist or asthma educator.



Mini Wright®
Peak Flow Meter

Vitalograph®
asmaPLAN+



Truzone®
Peak Flow Meter

Follow these five steps for using a Peak Flow Meter:

1. Move the indicator to the bottom of the numbered scale.
2. Stand up, or sit upright.
3. Take a deep breath in, and fill lungs completely.
4. Place the mouthpiece in mouth and close lips around it.
5. Blow out as hard and fast as possible in a single blow.

- Write down the value. If coughing occurred, the value is inaccurate. Do not record. Repeat the test.
- Repeat steps 1 through 5 two more times.
- Take the highest result of the three, and record.

Finding the Personal Best Peak Flow Number

The child's personal best peak flow number is the highest peak flow number achieved over a 2 to 3 week period when asthma is under good control.

Each child's asthma is different, and the "best" peak flow value may be higher or lower than another child's of the same height, weight, and sex. The action plan needs to be based on the child's personal best peak flow value.

To identify the child's personal best peak flow number, have the child take peak flow readings:

- At least twice a day for 2 to 3 weeks. Document readings to observe trends.
- Upon awakening and before bed.
- Prior to and 15 minutes after taking a short-acting inhaled bronchodilator (reliever).

Reference values for Peak Expiratory Flow Rates (> 6 years old)

These reference values for Peak Expiratory Flow rates are provided as an example only. They are not applicable for every PEF meter. Use the reference values provided by the manufacturer for the specific PEF meter being used.

Note: age, effort and understanding influence reliability

Height (cm)	Male (L/min)	Female (L/min)
110	–	145
115	160	157
120	175	170
125	191	184
130	208	199
135	226	216
140	247	234
145	269	253
150	293	274
155	319	396
160	348	321
165	379	347
170	414	376
175	451	407
180	491	441

Reference: Canadian Association of Emergency Physicians (2000). *Guidelines for Emergency Management of Paediatric Asthma*. [Online]. Available: http://www.caep.ca/002.policies/002-01.guidelines/paediatric-asthma/paediatric-asthma.htm

Appendix G: Asthma Medications

Relievers and Controllers

The following table provides a comparison of asthma medications (relievers and controllers), their actions, side effects and pharmacokinetics. It does not include all generic and brand names of asthma medication, but includes the majority of commonly used medications for asthma management.

For Delivery Devices:

MDI <5 years – Valved holding chamber (i.e. AeroChamber®, OptiChamber®) with mask of appropriate size*

≥5 years – Valved holding chamber (i.e. AeroChamber®, OptiChamber®) with mouth piece

– For children and youth who do not want to use a valved holding chamber, use Diskus® or Turbuhaler®

*Recommended ages for each size of valved holding chamber

AeroChamber®

- Infant Mask (Orange) – 0 to 18 months
- Child Mask (Yellow) – 12 months to 5 years
- Adult Mouthpiece (Blue) – 5 years and older

OptiChamber® (with detachable masks)

- Small – 0 to 18 months
- Medium – 1 to 6 years
- No Mask – 6 years and older

(Adult Mask for both brands should be used rarely, i.e., for older children with developmental delay)

Note: Nasal filtration may prevent approximately 67% of medication from reaching the lungs (worse when crying), therefore it is recommended that **children use a spacer with a mouthpiece as soon as the child is developmentally able** (Chua et al., 1994).

Legend:

MDI(CFC) – Metered dose inhaler, chlorofluorocarbon propelled

MDI(HFA) – Metered dose inhaler, hydrofluoroalkane propelled

PD – Powder Device

Relievers

Medications	Actions	Side Effects	Pharmacokinetics
Short acting ß$_2$-agonists:			
salbutamol • Airomir® MDI (HFA) 100µg • Apo-Salvent® MDI (HFA) 100µg • Novo-salmol® MDI (HFA) 100µg • Ventolin® Diskus® PD 200µg • Ventolin® MDI (HFA) 100µg • Ventolin® Nebules® Wet Nebulization 0.5mg/ml, 1.0mg/ml, or 2.5mg/ml terbutaline • Bricanyl® Turbuhaler® PD 500µg fenoterol • Berotec® MDI 100µg • Berotec® vials Wet Nebulization 0.25 mg/ml, 0.625 mg/ml	• Promotes bronchodilation through stimulation of ß$_2$-adrenergic receptors thereby relaxing airway smooth muscle **Onset of action:** a few minutes **Peaks:** 15-20 minutes **Duration:** 2-4 hours, fenoterol up to 8 hours	• tremor • tachycardia • headache • nervousness • palpitations • insomnia	salbutamol **Absorption:** 20% inhaled, well absorbed (PO) **Distribution:** 30% inhaled, crosses blood-brain barrier, crosses placenta **Metabolism:** liver extensively, tissues **Excretion:** mostly urine, feces, breast milk **Half-Life:** 4-6 hrs terbutaline **Absorption:** partially absorbed (PO), minimal (inhalation) **Distribution:** crosses placenta **Metabolism:** liver, gut wall **Excretion:** bile, feces, urine, breast milk **Half-Life:** unknown fenoterol **Absorption:** minimal (inhalation) incomplete (PO) **Distribution:** unknown **Metabolism:** liver, 90% **Excretion:** breast milk, kidney 12% **Half-Life:** 7 hours
Anticholinergic:			
ipratropium bromide • Atrovent® MDI 20µg • Atrovent® Wet Nebulization 125µg/ml and 250 µg/ml	• An anticholinergic drug that has been shown to have bronchodilator properties • Reduces vagal tone to the airways **Onset of action:** 5-15 minutes **Peaks:** 1-2 hours **Duration:** 4-5 hours	• dry mouth • bad taste • tremor	ipratropium bromide **Absorption:** minimal **Distribution:** does not cross blood-brain barrier **Metabolism:** liver, minimal **Excretion:** urine, feces **Half-Life:** 3-5 hrs

Medications	Actions	Side Effects	Pharmacokinetics
Methylxanthine:			
aminophylline • Phyllocontin® SRT theophylline • Apo-Theo-LA SRT® • Novo-Theophyl SRT® • Quibron-T® • Theochron SRT® • Theolair SRT® 24-Hour: theophylline Uniphyl®	• relaxes airway smooth muscle • may have some anti-inflammatory effect • clients may benefit even when serum levels are low	• Are usually caused by a high serum concentration of the drug or the client's inability to tolerate the drug and include: • upset stomach with heartburn • nausea • diarrhea • loss of appetite • headache • nervousness • insomnia • tachycardia • seizures	theophylline **Absorption:** well absorbed (PO), slowly absorbed (extended release) **Distribution:** crosses placenta, widely distributed **Metabolism:** liver **Excretion:** kidneys, breast milk **Half-Life:** 3-13 hrs, increased in liver disease, CHF and elderly; decreased in smokers **Several drug interactions include:** • antibiotics • birth control pills

Controllers

Medications	Actions	Side Effects	Pharmacokinetics
Glucocorticosteroids (inhaled):			
beclomethasone • Alti-beclomethasone® MDI 50µg • QVAR® MDI(HFA) 50µg, 100µg budesonide • Pulmicort® Nebuamp® Wet Nebulization 0.125mg/ml, 0.25mg/ml and 0.5mg/ml • Pulmicort® Turbuhaler® PD100µg, 200µg, and 400µg fluticasone • Flovent® Diskus® PD 50µg, 100µg, 250µg, and 500µg • Flovent® MDI(HFA) 25µg, 50µg, 125µg, and 250µg	• Prevents and suppresses activation and migration of inflammatory cells • Reduces airway swelling, mucus production, and microvascular leakage • Increases responsiveness of smooth muscle beta receptors	Inhaled route (up to equivalent of 1000 µg/ day beclomethasone): • sore throat • hoarse voice • thrush • cough Rinsing, gargling and expectorating after inhalation can minimize these side effects. A spacer should be used with MDIs to reduce side effects.	beclomethasone Absorption: 20% Distribution: 10-25% in airways (no spacer) Metabolism: minimal Excretion: less than 10% in urine/feces Half-Life: 15 hrs budesonide Absorption: 39% Distribution: 10-25% in airways (no spacer) Metabolism: liver Excretion: 60% urine, smaller amounts in feces Half-Life: 2-3 hrs fluticasone Absorption: 30% aerosol, 13.5% powder Distribution: 10-25% in airways (no spacer), 91% protein binding Metabolism: liver Excretion: less than 5% in urine, 97-100% in feces Half-Life: 14 hrs

Medications	Actions	Side Effects	Pharmacokinetics
Glucocorticosteroids (oral/intravenous):			
ORAL prednisone • Prednisone 5 and 50 mg tablets • Deltasone® 5mg and 50mg tablets prednisolone • Pediapred® 1mg/ml liquid methylprednisolone • Medrol® 4 mg tablets dexamethasone • Decadron® 0.5mg, 4mg tablets **INTRAVENOUS** methylprednisolone SoluCortef ® SoluMedrol ®		**Oral or IV route – short term (less than 2 weeks):** • weight gain • increased appetite • menstrual irregularities • mood changes • muscle cramps • mild reversible acne • hyperglycemia (IV) **Oral route – long term (more than 2 weeks):** • adrenal suppression • immuno-suppression • osteoporosis • hyperglycemia • hypertension • weight gain • cataracts • glaucoma • peptic ulcer • ecchymosis • avascular necrosis of the hip	prednisone **Absorption:** well absorbed **Distribution:** widely distributed; crosses placenta **Metabolism:** liver, extensively **Excretion:** kidney, breast milk **Half-Life:** 3-4 hrs IV steroids: **Absorption:** rapid **Distribution:** widely distributed **Metabolism:** liver **Excretion:** kidneys **Half-Life:** 18 - 36 hrs, depending on the drug
Long-Acting ß$_2$-agonists:			
formoterol • Foradil® PD 12µg • Oxeze® Turbuhaler® PD 6µg and 12µg salmeterol • Serevent® Diskus® PD 50µg • Serevent® MDI(CFC) 25µg • Serevent® Diskhaler® PD 50µg	• Promotes bronchodilation through stimulation of ß$_2$-adrenergic receptors thereby relaxing airway smooth muscle formoterol **Onset of action:** 1-3 minutes **Duration:** 12 hours salmeterol **Onset of action:** 10-20 minutes **Duration:** 12 hours	• tremor • tachycardia • headache • nervousness • palpitations • insomnia	formoterol **Absorption:** rapid, lung deposition 21-37% **Distribution:** plasma protein binding approximately 50% **Metabolism:** liver, extensive **Excretion:** 10% unchanged in urine **Half-Life:** approximately 8-10 hours salmeterol **Absorption:** minimal systemic **Distribution:** local **Metabolism:** liver first pass **Excretion:** unknown **Half-Life:** 5.5 hrs

Medications	Actions	Side Effects	Pharmacokinetics
Anti-Leukotrienes:			
montelukast • Singulair® 4 mg, 5mg and 10mg tablets • Singulair® 4 mg oral granules zafirlukast • Accolate® 20mg tablets	• Blocks the action of leukotrienes that are released by the membranes of inflammatory cells in the airways • *Note:* Bioavailability is reduced with Accolate when given with food	montelukast • headache • abdominal pain zafirlukast • headache • indigestion • stomach upset	montelukast **Absorption:** rapidly **Distribution:** protein binding 99% **Metabolism:** liver **Excretion:** bile **Half-Life:** 2.7-5.5 hrs zafirlukast **Absorption:** rapid after oral administration **Distribution:** enters breast milk, 99% protein binding **Metabolism:** liver **Excretion:** feces, breast milk, 10% unchanged by kidneys **Half-Life:** 10 hrs
Non-steroidal (anti-allergic) Anti-inflammatory:			
nedocromil sodium • Tilade® MDI(CFC) 2mg sodium cromoglycate • Intal Ampules® Wet Nebulization 2ml:10mg/ml • Intal® MDI(CFC) 1mg	• Inhibits the mediator release from mast cells	nedocromil sodium • headache • stomach upset • bad taste • cough sodium cromoglycate • throat irritation • cough	nedocromil sodium **Absorption:** 90% inhaled dose swallowed; 2.5% of dose swallowed is absorbed; inhaled drug that reaches the lung is completely absorbed; bioavailability 6-9% **Distribution:** 28%-31% protein binding **Metabolism:** liver (metabolite) **Excretion:** unchanged in bile and urine **Half-Life:** 1.5-2.3 hrs sodium cromoglycate **Absorption:** poorly **Distribution:** unknown **Metabolism:** unknown **Excretion:** unchanged mostly in feces, bile and urine **Half-Life:** 80 min

Medications	Actions	Side Effects	Pharmacokinetics
Combination Drugs:			
Long-acting bronchodilators and inhaled steroids budesonide and formoterol • Symbicort® Turbuhaler® PD 100/6µg, 200/6µg fluticasone and salmeterol • Advair® Diskus® PD 100/50µg, 250/50µg, 500/50µg • Advair® MDI(HFA) 125/25µg, 250/25µg	• the same as those listed for each medication separately		

Proposed dose equivalencies for inhaled glucocorticosteroids

	Dose – µg/d		
Product	**Low**	**Medium**	**High**
BDP MDI and spacer	≤ 400	401 – 1000	> 1000
BUD Turbuhaler®	≤ 400	401 – 800	> 800
FP MDI and spacer	≤ 250	251 – 500	> 500
FP Diskus®	≤ 250	251 – 500	> 500
BDP MDI(HFA)	≤ 250	251 – 500	> 500
BUD Wet Nebulization	≤ 1000	1001 – 2000	> 2000

Legend:
BDP – beclomethasone dipropionate
MDI – metered dose inhaler
BUD – budesonide
FP – fluticasone propionate
HFA – hydrofluoralkane

Source: *Canadian Asthma Consensus Report*. (Boulet et al., 1999, p 24S.)

Appendix H: Device Techniques

Medications: Inhalation Devices

Adapted with permission from The Lung Association: www.lung.ca/asthma/manage/devices.html

Asthma medications come in many forms. However, most often they are taken by the inhaled route:

- Metered Dose Inhaler (puffer)
- Dry Powder Inhalers (Turbuhaler®, Diskus®, Diskhaler®)
- Nebulizer

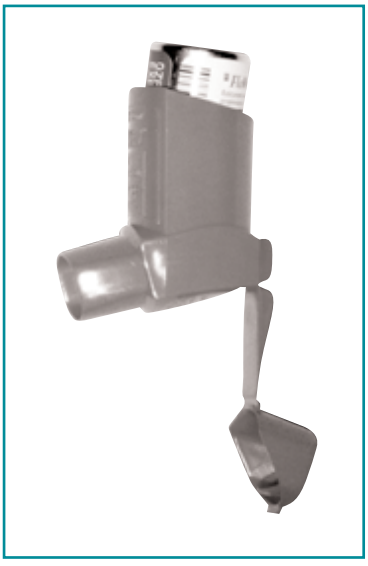
Accurate technique for using these devices is extremely important.

Delivery Device

The inhaled route is the most effective method to deliver the medication directly to the airways. As a result of using the inhaled route, the total dose of medication required is greatly reduced thereby reducing the chance for the medication to have a systemic effect.

A. Metered Dose Inhalers (MDI)

Metered dose inhalers (MDI), or puffers, deliver a precise dose of medication to the airways when used appropriately. It is very important to have a good technique. A holding chamber or spacer is recommended for use with a MDI, particularly for those not able to use a puffer accurately. To tell if the puffer is empty: (1) calculate the number of doses used, or (2) invert or shake it close to the ear several times and listen/feel for movement of liquid. One advantage of using the MDI is that it is quite portable. A number of different metered dose inhalers are available. Different pharmaceutical companies manufacture similar medications that are in different inhalers.



Metered Dose Inhaler

Metered Dose Inhaler: Proper Use

1. Remove the cap from the mouthpiece and shake the inhaler.
2. Breathe out to the end of a normal breath.
3. a) Position the mouthpiece end of the inhaler about 2-3 finger widths from the mouth, open mouth widely and tilt head back slightly, OR
   b) Close lips around the mouthpiece and tilt head back slightly.
4. Start to breathe in slowly, and then depress the container once.
5. Continue breathing in slowly until the lungs are full.
6. After breathing in fully, HOLD breath for 10 seconds or as long as possible, up to 10 seconds.
7. If a second puff is required, wait one minute and repeat the steps.

Care of a Metered Dose Inhaler

Keep the inhaler clean. Once a week, remove the medication canister from the plastic casing and wash the plastic casing in warm, soapy water. When the casing is dry, replace the medication canister in the casing and place the cap on the mouthpiece. Ensure that the hole is clear. Check the expiry date. Check to see how much medication is in the inhaler as described in the previous section.

Holding Chambers/Spacers

A number of different holding chambers are available on the market. Different pharmaceutical companies make different devices. All these devices are effective. The difference between them is the cost and durability.

Holding Chamber/Spacer

Holding chambers are devices with one-way valves that hold the medication for a few seconds after it has been released from the inhaler. This allows the client the advantage of taking more than one breath in for each puff when unable to hold their breath, particularly in an acute episode or in the case of young children. There are masks available for children with some of

the devices. The child must remember to wait a minute between each puff of the inhaler, even when using a holding chamber. This ensures the patient is receiving the prescribed amount of medication. Holding chambers are indicated for all individuals who:

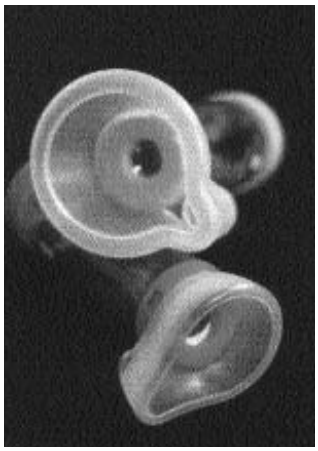
- Use a Metered Dose Inhaler
- Have trouble coordinating the hand-breath step
- Are using inhaled steroids

When a holding chamber and inhaler are used, the larger particles drop down into the holding chamber. This limits the amount of particles in the mouth and throat, which in turn limits the amount absorbed systemically.

Using a holding chamber may prevent a hoarse voice or sore throat which can occur with inhaled steroid use. Whether a holding chamber is used or not, individuals using inhaled steroids should gargle after treatment.

Proper Use of a Holding Chamber with Mask:

1. Remove the cap from the mouthpiece and shake the inhaler.
2. Place the MDI upright in the holding chamber's back rubber opening.
3. Place the mask over the child's nose and mouth to make a firm seal. The valve on the mask will move with each breath taken by the child.
4 Press down on the canister, releasing one puff of medication.
5. Hold the mask in place until the child has taken six breaths. If the child is able, slow deep breaths taken through the mouth are most effective.
6. If a second puff is required, wait 60 seconds and repeat steps 3-5.



Holding Chamber with Mask

Note: The mask may seem scary to a child at first. The child may need reassurance – pretending to use the mask yourself may help to show the child it is safe. If the child cries while receiving the medication, the medication will still be delivered to the lungs as long as the seal on the mask is tight. Around the age of 5, a child should be ready to transition to a holding chamber with mouthpiece when they are able to take a full breath in and hold.

Proper Use of a Holding Chamber:

1. Remove the cap on the inhaler (MDI) and holding chamber mouthpiece.
2. Shake the inhaler well immediately before each use. Insert the inhaler (MDI) into the back rubber opening on the chamber.
3. Put mouthpiece into mouth.
4. Depress inhaler (MDI) at beginning of slow deep inhalation. Hold breath as long as possible, up to 10 seconds before breathing out. If this is difficult, an alternative technique is to keep mouth tight on mouthpiece and breathe slowly 2-3 times after depressing inhaler (MDI).
5. Administer one puff at a time.
6. Slow down inhalation if "whistling" sound is heard.
7. Follow instructions supplied with the inhaler (MDI) on amount of time to wait before repeating steps 3 – 6, as prescribed.
8. Remove the inhaler and replace the protective caps after use.

Care of a Holding Chamber (with/without mask)

Whichever holding chamber is used, it must be cleaned at least once a week with warm soapy water, rinsed with clean water, and air dried in a vertical position.

B. Dry Powder Inhalers (DPIs)

There are several dry powder inhalers available. Examples include the Turbuhaler®, the Diskus®, and the Diskhaler®.

General points of dry powder inhalers include:

- A quick forceful breath in is required to deliver the medications to the lungs, versus a slow breath for MDIs.
- Some DPIs contain a lactose carrier or filler.

Turbuhaler: Proper Use

1. Unscrew the cover and remove it.
2. Holding the device upright, turn the coloured wheel one way (right) and back (left) the other way until it clicks. Once the click is heard, the device is loaded.
3. Breathe out.
4. Place the mouthpiece between lips and tilt head back slightly.
5. Breathe in deeply and forcefully.
6. Hold breath for 10 seconds or as long as possible up to 10 seconds.
7. If a second dose is prescribed, repeat the steps.

Turbuhaler®

When a red mark first appears in the little window, only twenty doses remain. The Turbuhaler® is empty and should be discarded when the red mark reaches the lower edge of the window. Newer Turbuhaler® devices have a counter that appears in a little window to show the number of doses left.

Care of a Turbuhaler®

Clean the mouthpiece two or three times a week. Using a dry cloth, wipe away any particles that have collected on the mouthpiece. Never wash the mouthpiece.

Diskus®: Proper Use

1. *Open* – Place thumb on thumb grip. Push thumb away from body as far as it will go.
2. *Slide* – Slide the lever until a click is heard. Breathe out away from the Diskus®.
3. *Inhale* – Seal lips around the mouthpiece. Breathe in steadily and deeply through mouth. Hold breath for about 10 seconds, then breath out slowly.
4. *Close* – Place thumb on thumb grip, and slide the thumb grip towards body, as far as it will go.

Important: If more than one dose is prescribed, repeat steps 2 – 4. Rinse your mouth after using Flovent® or Advair®.

Diskus®

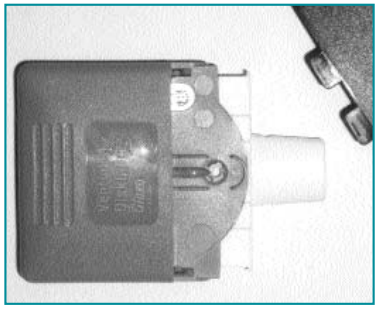
Care of a Diskus®

The dose counter displays how many doses are left or when the inhaler is empty. Keep the Diskus® closed when not in use, and only slide the lever when ready to take a dose.

Diskhaler®: Proper Use

1. To load the Diskhaler®, remove the cover and cartridge unit.
2. Place a disk on the wheel with the numbers facing up and slide the unit back into the Diskhaler®.
3 Gently push the cartridge in and out until the number 8 appears in the window.
4. The Diskhaler® is now ready for use.
5. Raise the lid up as far as it will go – this will pierce the blister.
6. Close the lid.

7. Breathe out.
8. Place the mouthpiece between the teeth and lips – make sure not to cover the air holes at the sides of the mouthpiece.
9. Tilt head back slightly.
10. Breathe in deeply and forcefully.
11. Hold breath for 10 seconds or as long as possible.
12. Sometimes 2 or 3 forceful breaths in are needed to make sure all the medication is taken.
13. If a second blister is prescribed, advance the cartridge to the next number and repeat steps 5 – 11.



Diskhaler®

Care of a Diskhaler®

Remove the cartridge and wheel. Clean any remaining powder away using the brush provided in the rear compartment before replacing the cartridge and wheel.

C. Nebulizers (Compressors)

Nebulizer

A nebulizer or compressor is used mostly for small children. No hand-breath coordination is required. Each treatment requires sitting quietly for 20 – 30 minutes while the drug is nebulized from a liquid to a mist.

The nebulizer is generally not portable unless you have a 3-way system. The 3-way nebulizer can be plugged into an electrical outlet, has an adaptor for use in a vehicle's cigarette lighter, and can be battery operated. Both the 3-way machine and the regular nebulizers are expensive and must be serviced regularly. The inhalers, when used properly, are as effective as using a nebulizer.

Care of Nebulizer and Equipment

Wash mask with hot, soapy water. Rinse well and allow to air dry before re-use.

Appendix I: Educational Resources – Behavioural Approach

By today's standards, asthma education that looks only at increasing knowledge has little effect on building self management skills and does not necessarily lead to positive asthma control outcomes. Using behavioural approaches to build and maintain asthma management skills is essential (Boulet et al., 1999; Osman, 1996).

The following is a summary of theories and models of health education that support models of behaviour change in asthma self-management.

Articles	Summary
Overview: Clark, M., Gotsch, A., & Rosenstock, I. R. (1993). Patient, professional, and public education on behavioural aspects of asthma: A review of strategies for change and needed research. *Journal of Asthma, 30*(4), 241-255.	■ A review of existing research on patient education and management of asthma. ■ Strategies to improve asthma education are discussed. ■ Supports incorporation of theories as basis for asthma education.
Green, L. W., & Frankish, C. J. (1994). Theories and principles of health education applied to asthma. *CHEST, 106*(4), 219S-230S.	■ Discusses some principles of behaviour change that underlie attempts to effectively counsel patients with asthma. ■ Identification of underlying principles make explicit the implicit assumptions and theories of behaviour change that are inherent in various treatment approaches to asthma.
Communication-Behaviour Change Model: Mattarazzo, J., Miller, N., Weiss, S. (1984). *Behavioral health: A handbook of health enhancement and disease prevention.* New York: Wiley.	■ Model of behaviour change that combines principles of existing theories.

Articles	Summary
Health belief model: Rosenstock, I. (1974). Historical origins of the health belief model. *Health Education Monographs, 2*, 328-343	■ A theoretical framework for measuring the probability that an individual will make use of health recommendations based on their belief of risk and susceptibility.
Locus of Control Theory: Wallston, B., & Wallston, K. (1978). Locus of Control and Health. *Health Education Monographs, 6,* 107-115.	■ Describes Rotter's Locus of Control theory that is based on the premise that health behaviour is influenced by a person's perception of their locus of control. ■ External control is when illness is felt to be out of an individual's control (luck, fate, chance), whereas internal control is felt to be determined by their own behaviour. ■ A multidimensional Locus of Control scale is used to assess client perceptions.
Representational Approach: Donovan, H. S., & Ward, S. (2001). A representational approach to patient education. *Journal of Nursing Scholarship, 33*(3), 211-216.	■ Describes an approach to patient education that is based on Leventhal's common sense model; a theory that has guided research on coping with health threats.
Self-Regulation Theory: Clark, N. M., Gong, M., & Kaciroti, N. (2001). A model of self-regulation for control of chronic disease. *Health Education and Behavior, 28*(6), 769-782.	■ A model of patient management of chronic disease that accounts for intrapersonal and external influences on management and emphasizes the central role of self-regulatory processes in disease control.

Articles	Summary
Zimmerman, B. J., Bonner, S., Evans, E. et al. (1999). Self-regulating childhood asthma: A developmental model of family change. *Health Education and Behavior, 26*(1), 55-71.	■ Tests a model of self-regulatory development ■ Families' cognitive beliefs and behavioural skills for managing asthma symptoms emerge in four successive phases: asthma symptom avoidance, asthma acceptance, asthma compliance, and asthma self-regulation.
Social Learning Theory: Bandura, A. (1986). *Social foundations of thought and action.* Englewood Cliffs. NJ: Prentice-Hall.	■ Describes an interpersonal behaviour theory that sees behaviour as a product of several personal and environmental factors.
Stages of Change Theory: Cassidy, C. A. (1999). Point of view: Using the transtheoretical model to facilitate behavior change in patients with chronic illness. *Journal of the American Academy of Nurse Practitioners. 11*(7), 281-287.	■ The transtheoretical model assists health care providers in developing interventions that are specifically focused for the patient depending on stage of readiness to change. ■ Application of the model in the practice setting is discussed, and a specific example of activities developed for use in patients with asthma is given.
Prochaska, D., & DiClimente, C. (1992). In search of how people change: Applications to addictive behaviour. *American Psychologist, 47,* 1102-1114.	■ Stage measures provide differential predictions for the amount of progress people at different stages will make after treatment. ■ Assessing processes of change that people apply to progress from one stage to the next can help explain the dynamics of behaviour change.

Appendix J: Asthma Action Plans/Symptom Diaries

Asthma Action Plans

Children's Hospital of Eastern Ontario (see sample)
Available online: http://www.cheo.on.ca/english/asthma_action_plan.pdf

The Hospital for Sick Children (see sample)

The Lung Association (see sample)
Available online: http://www.on.lung.ca/asthmaaction/action_plan.html

Peak Flow/Symptom Diary

Alberta Asthma Centre (see sample)

BetterHealth4Kids.com: Asthma Symptom Diary for School Age Children
Available online: www.betterheatlh4kids.com/asthmaschooldiary.pdf

BetterHealth4Kids.com: Asthma Symptom Diary for Infants and Toddlers
Available online: www.betterhealth4kids.com/asthmababydiary.pdf

The Lung Association (see sample)
Available online: http://www.lung.ca/asthma/manage/asthma_diary.pdf

Sample Asthma Action Plan – Children's Hospital of Eastern Ontario

CHEO Children's Hospital of Eastern Ontario
Centre hospitalier pour enfants de l'est de l'Ontario

MY ASTHMA ACTION PLAN

Peak Flow ↓

The most common trigger in children is COLDS. You should avoid cigarette smoke and may need to avoid dust, mold, cats, dogs, or cold air.

Comments: _____

Physician's Signature _____ Date _____ Reviewed by _____ Date _____

Space for child identification

100% (Personal Best)

GREEN ZONE: Doing well
- Breathing is good
- Cough or wheeze is only occasional (less than 4 times a week)
- Can run and play normally

☐ Controller ☐ _____ , ___ puff(s), _____ time(s) a day
Medication(s): ☐ _____ , ___ puff(s), _____ time(s) a day
☐ _____ , _____ dose, _____ time(s) a day
☐ Quick Relief ☐ _____ , ___ puff(s), less than 4 times a week
Medication(s): ☐ Before exercise: _____ , ___ puff(s)

80%

YELLOW ZONE: Caution
- Signs of a cold
- Cough or wheezing
- Tight chest
- Waking up at night because of asthma

☐ Continue with GREEN ZONE medications.
☐ Increase _____ (controller) to ___ puff(s), ___ times a day, for ___ day(s)
☐ Take _____ (quick relief) , ___ puff(s) every 4-6 hours until better
☐ Other: _____

70%

RED ZONE: Medical Alert
- Very short of breath
- "Pulling in" of skin between ribs
- Cannot do usual activities
- Quick relief medication not helping or helping for less than 4 hours

Take _____ (quick relief) , ___ puff(s) every 4 hours
Seek medical attention NOW and follow EMERGENCY plan if:
- You are still in red zone after 15 minutes OR
- You have not reached your doctor

50%

EMERGENCY:
- Severe trouble breathing, walking, or talking
- Blueness of lips or skin
- Tired because of the effort of breathing

GO TO THE NEAREST EMERGENCY DEPARTMENT NOW
Take your quick relief medication as necessary (even every 10-20 minutes if you are not improving) on your way to the hospital.
In Ottawa, you can call **911** in case of emergency.

Sample Asthma Action Plan – The Hospital for Sick Children

Asthma Action Plan for: _____

My Child's Asthma is in Control when:

- No cough or other symptoms during daytime
- No cough or symptoms during the night and early morning
- Able to do normal activities
- Rescue medication needed less than three times a week

What Medications Help Keep My Child with Asthma Healthy?

Medication(s) & Strength & Device	Dose	Times per day
Preventer/Controller (**EVERY DAY**)		
Rescue/Reliever (only when needed)		

Sample Asthma Action Plan – The Hospital for Sick Children (cont.)

What Do I Do If My Child's Asthma is Getting Worse?

Medication(s) & Strength & Device	Dose	Times per day

Date_____ MD/NP_____

Date_____ Asthma Educator_____

In an Emergency:

See Doctor RIGHT AWAY if:

1. rescue medication does not work, or last four hours, **OR**
2. your child is not improving after two or three days, **OR**
3. your child is getting worse

If your child is:

- **short of breath OR,**
- **breathing fast OR,**
- **coughing continuously even with treatment,**

you may give extra rescue medication (i.e., ventolin, bricanyl) every 20 minutes for a total of three doses *then* go to nearest Emergency Department.

Go to the nearest Emergency Department if:

1. Your child is unable to eat, sleep or speak due to symptoms, **OR**
2. Your child's breathing appears jerky, or is sucking in at the throat or below the ribs, **OR**
3. extra rescue medication does not work.

Sample Asthma Action Plan – The Lung Association

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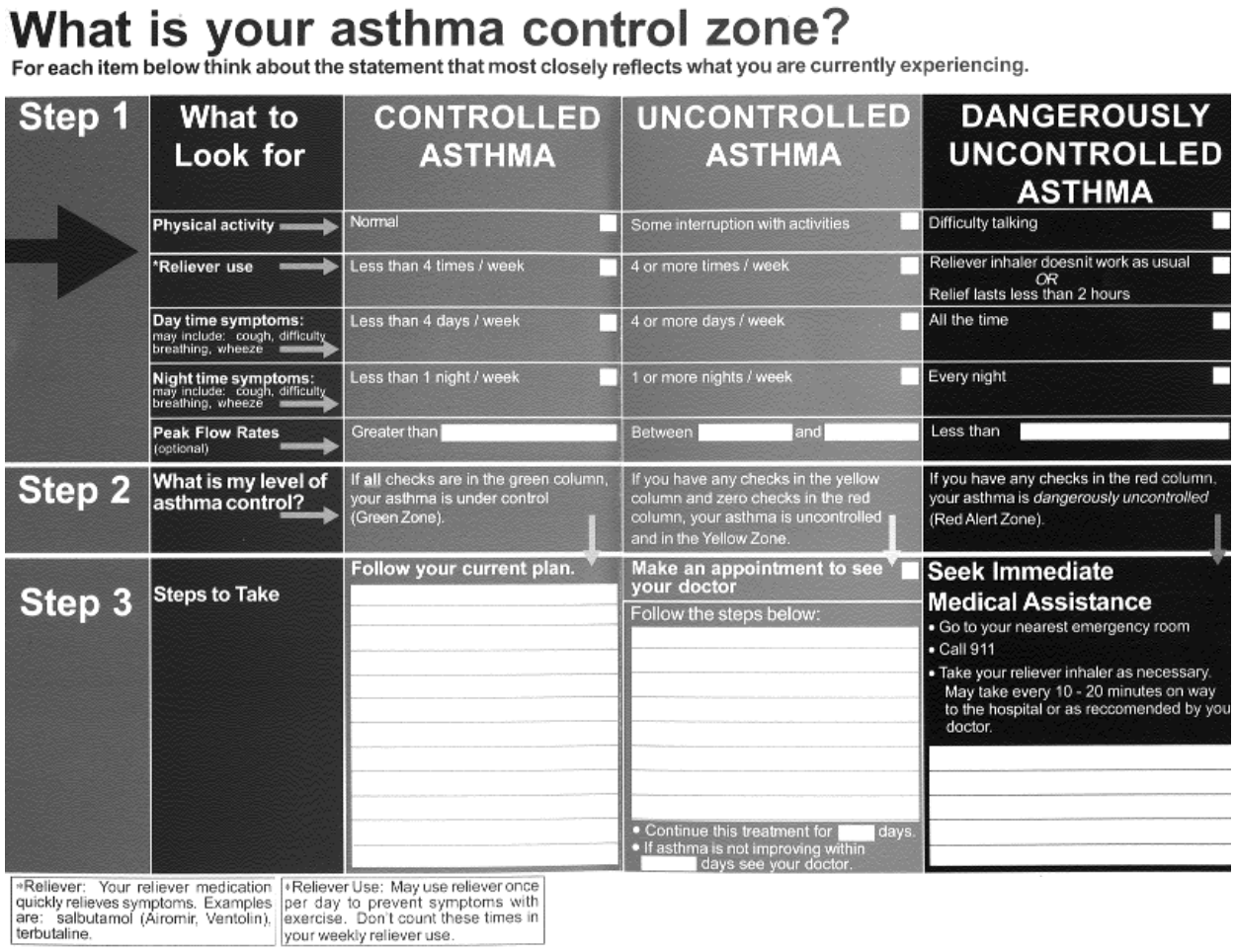


What is your asthma control zone?

For each item below think about the statement that most closely reflects what you are currently experiencing.

Step 1	What to Look for	CONTROLLED ASTHMA	UNCONTROLLED ASTHMA	DANGEROUSLY UNCONTROLLED ASTHMA
	Physical activity	Normal ☐	Some interruption with activities ☐	Difficulty talking ☐
	*Reliever use	Less than 4 times / week ☐	4 or more times / week ☐	Reliever inhaler doesnit work as usual ☐ *OR* Relief lasts less than 2 hours
	Day time symptoms: may include: cough, difficulty breathing, wheeze	Less than 4 days / week ☐	4 or more days / week ☐	All the time ☐
	Night time symptoms: may include: cough, difficulty breathing, wheeze	Less than 1 night / week ☐	1 or more nights / week ☐	Every night ☐
	Peak Flow Rates (optional)	Greater than _____	Between _____ and _____	Less than _____
Step 2	**What is my level of asthma control?**	If **all** checks are in the green column, your asthma is under control (Green Zone).	If you have any checks in the yellow column and zero checks in the red column, your asthma is uncontrolled and in the Yellow Zone.	If you have any checks in the red column, your asthma is *dangerously uncontrolled* (Red Alert Zone).
Step 3	**Steps to Take**	**Follow your current plan.**	**Make an appointment to see your doctor** ☐ Follow the steps below: • Continue this treatment for ____ days. • If asthma is not improving within ____ days see your doctor.	**Seek Immediate Medical Assistance** • Go to your nearest emergency room • Call 911 • Take your reliever inhaler as necessary. May take every 10 - 20 minutes on way to the hospital or as reccomended by you doctor.

*Reliever: Your reliever medication quickly relieves symptoms. Examples are: salbutamol (Airomir, Ventolin), terbutaline.

*Reliever Use: May use reliever once per day to prevent symptoms with exercise. Don't count these times in your weekly reliever use.

Sample Peak Flow/Symptom Diary – Alberta Asthma Centre

Monitor Your Asthma Control:

Answer these questions each day:
(Look at the responses below to help answer the questions.)

A. Did you wheeze, cough or have trouble breathing today?
B. Did you wake up last night and wheeze, cough or have trouble breathing?
C. Did you have trouble playing today because of your asthma?
D. Did you miss school today because of your asthma? Y=yes N=no
E. Did you go to the doctor or hospital today because of your asthma? Y=yes N=no

A. Responses:
0 = not at all
1 = a little bit
2 = yes, I took my reliever medicine
3 = yes, a lot

B. Responses:
0 = not at all
1 = yes, but I fell back asleep
2 = yes, I needed my reliever medicine
3 = yes, I woke up a lot

C. Responses:
0 = not at all
1 = a little bit
2 = some, I had to take my reliever medicine
3 = a lot, I had to stop playing

Peak Flow:

- A peak flow meter can sometimes help you know how well your asthma is controlled.
- Mark on the graph the best of your three blows.
- Do this in the morning and the evening or as needed.
- Do your peak flow before you take your medication, or as advised by your doctor.

Asthma Medicine:

- Print the names of your asthma medicine below.
- When you use your medicine, mark the number of puffs or pills you take on the chart.

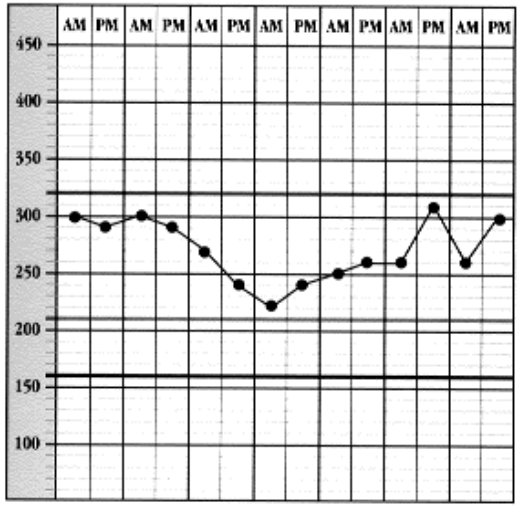
Medicine	Dose
1. (Preventer)	
2.	
3. (Reliever)	
4.	
5.	

Notes:

- Print things that may have triggered your asthma today such as smoke, colds and running.
- Print any other medicine you took today.

Sample chart on right ▶

DATE	July 3	4	5	6	7	8	9
WK 1	MON	TUE	WED	THUR	FRI	SAT	SUN
a.	0	0	2	2	1	1	2
b.	0	0	1	2	1	0	1
c.	0	0	1	1	1	0	0
d.	N	N	N	Y	N	N	N
e.	N	N	N	N	N	N	N



1.	\\	\\	\\\\	\\\\	\\\\	\\\\	\\\\
2.							
3.			\\	\\	\\	\\	\
4.							
5.							
	BIKE RIDE	ROLLER BLADING	SORE THROAT - RESTED	COLD	COLD	FEELING BETTER	AT FRIENDS WITH CATS

Date: _____

Completed with Dr.: _____

When my asthma feels great, I:
- Stay away from my triggers
- Watch for asthma problems
- Take medicine: _____
- _____
- _____
- _____
- _____
- _____

When my asthma feels different, I:
- Stay away from my triggers
- Tell an adult
- Keep track of my asthma
- Take medicine: _____
- _____
- _____
- _____
- _____

When my asthma feels bad, I:
- Ask an adult for help
- Rest
- Seek medical attention
- Take medicine (optional): _____
- _____
- _____
- _____
- _____

When my asthma scares me, I:
- Call 911 or _____
- Go to the hospital now
- My doctor's number is: _____
- Take medicine: _____
- _____
- _____
- _____
- _____

Sample Peak Flow/Symptom Diary – The Lung Association

Reproduced with permission of The Lung Association.

ASTHMA DIARY FORM

Name _____ Dr. _____ Dr. Phone # _____

Date	THURS		FRI		SAT		SUN		MON		TUES		WED	
Time	day	night	day	night	day	night	day	night	day	night	day	night	day	night
SYMPTOMS														
Cough														
Wheeze														
Shortness of breath														
Chest Tightness														
Missed work/school for asthma														
Saw doctor for asthma symptoms														
Went to Emergency for asthma														

PEAK FLOW READINGS	day	night	day	night	day	night	day	night	day	night	day	night	day	night
500														
400														
300														
200														
100														
0														
ASTHMA MEDICINE	day	night	day	night	day	night	day	night	day	night	day	night	day	night

Symptom score: 1 = Barely Present 2 = Obviously Present 3 = Interferes With Activity

Appendix K: Child & Family Education/ Nursing Professional Development

The following resources are examples of educational resources that nurses may wish to consider in planning education for children and their families. This list is not meant to be inclusive, but provides a range of resources, in a variety of media.

Child & Family Education:

Websites:

- Alberta Asthma Centre – www.asthmacentre.org
- American Lung Association – www.lungusa.org/asthma
- Asthma and Allergy Information Association – www.calgaryallergy.ca/aaia/index.htm
- Asthma in Canada – www.asthmaincanada.com
- Asthma Society of Canada – http://www.asthma.ca/global/kids.php
- Asthma Kids – http://asthma-kids.ca
- The Asthma Centre – University Health Network – http://www.uhn.ca/programs/asthma/site/Index.html
- Canadian Asthma Consensus Guidelines Secretariat – www.asthmaguidelines.com
- Canadian Network for Asthma Care – www.cnac.net
- Children's Hospital of Eastern Ontario (asthma) – www.cheo.ca/english/disclaimer.html
- Family Physician Airways Group of Canada – www.asthmaactionplan.com
- Kids Health – http://www.kidshealth.org/index.html
- The Hospital for Sick Children (child physiology) – www.sickkids.on.ca/childphysiology
- The Lung Association – www.lung.ca

Books:

Binkley, K. (2002). *Allergies & asthma: A guide for patients.* Toronto, ON: Coles Notes Medical Series.

Gold, M. (2003). *The complete kid's allergy and asthma guide: The parent's handbook for children of all ages.* Richmond Hill, Robert Rose, Inc.

Kovesi, T. *Asthma in Children.* The Lung Association.
Available through The Lung Association's Asthma Action Helpline – 800-668-7682.

Other Resources:

CD-ROM: Starbright Asthma CD-ROM "QUEST for the CODE". Interactive CD-ROM game. www.hsn.com/com/starbright/default.aspx

VIDEO/DVD: *Arthur – Goes to the Doctor* (2001). VHS/DVD. Sony Wonder.

HELPLINE: The Lung Association – Asthma Action Helpline 800-668-7682

Alberta Asthma Centre – Roaring Adventures of Puff (RAP) Program: www.asthmacentre.org

The Lung Association

- *Asthma Action Program: Asthma Action Handbook*
  http://www.on.lung.ca/asthmaaction/handbook.html
- *Call Me Brave Boy*: A picture book for children 2-6 years of age, designed for a parent or caregiver to read to a child who has asthma.
  http://www.on.lung.ca/asthmaaction/resources.html
- *Asthma Active:* An activity book for children 7-12 years of age, which contains educational games that teach about asthma in a fun way.
  http://www.on.lung.ca/asthmaaction/resources.html

Nursing Professional Development:

Canadian Network for Asthma Care (CNAC) Approved Asthma Educator Programs:

The Canadian Network for Asthma Care (CNAC) has approved several asthma educator programs. Please refer to their website (www.cnac.net) for a full listing of approved programs. The Michener Institute for Applied Health Sciences is the primary program in Ontario. Subject to other criteria for certification, graduates of these approved programs will be eligible to sit for the Certified Asthma Educator (C.A.E.) Examination.

- **Asthma Educator Program of The Michener Institute for Applied Health Sciences – Toronto, Ontario**
  For registration information:
  Division of Continuing Education
  The Michener Institute for Applied Health Sciences
  222 St. Patrick Street, Toronto, ON M5T 1V4
  Tel: 416-596-3101 ext 3162
  1-800-387-9066 ext 3308
  Email: ce@michener.ca
  www.michener.ca

- The Canadian Network for Asthma Care lists several approved programs provided in other provinces and internationally by distance on their website at http://www.cnac.net/english/certprograms.html

Opportunities for Continuing Professional Development in Asthma Care:

The Ontario Lung Association's professional section, the Ontario Respiratory Care Society, has a respiratory health educator's interest group. This group offers an annual seminar, several evening sessions, a newsletter and other educational opportunities throughout the year. Please refer to the Ontario Respiratory Care Society's home page at http://www.on.lung.ca/orcs/mission.html or contact them at orcs@on.lung.ca

Appendix L: Description of the Toolkit

Best practice guidelines can only be successfully implemented if there are: adequate planning, resources, organizational and administrative support as well as appropriate facilitation. In this light, RNAO, through a panel of nurses, researchers and administrators has developed the *Toolkit: Implementation of Clinical Practice Guidelines* based on available evidence, theoretical perspectives and consensus. The *Toolkit* is recommended for guiding the implementation of any clinical practice guideline in a health care organization.

The *Toolkit* provides step-by-step directions to individuals and groups involved in planning, coordinating, and facilitating the guideline implementation. Specifically, the *Toolkit* addresses the following key steps in implementing a guideline:

1. Identifying a well-developed, evidence-based clinical practice guideline
2. Identification, assessment and engagement of stakeholders
3. Assessment of environmental readiness for guideline implementation
4. Identifying and planning evidence-based implementation strategies
5. Planning and implementing evaluation
6. Identifying and securing required resources for implementation

Implementing guidelines in practice that result in successful practice changes and positive clinical impact is a complex undertaking. The *Toolkit* is one key resource for managing this process.

The *Toolkit* is available through the Registered Nurses Association of Ontario. The document is available in a bound format for a nominal fee, and is also available free of charge off the RNAO website. For more information, an order form or to download the *Toolkit*, please visit the RNAO website at www.rnao.org/bestpractices

Notes:

Notes:

Review 2008

Nursing Best Practice Guideline

Shaping the future of Nursing

Promoting Asthma Control in Children

Guideline supplement

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Supplement Integration

This supplement to the nursing best practice guideline *Promoting Asthma Control in Children* is the result of a scheduled review of the guideline. As part of its commitment to ensure consistency with the best available evidence, the Registered Nurses' Association of Ontario (RNAO) has established a monitoring and review process which involves a full review of each guideline every 3 years.

Asthma affects a large number of children in Ontario and is the most common chronic childhood illness in North America. Every year, more children are developing asthma (Institute for Clinical Evaluative Sciences, 2004). Therefore, all nurses, across the continuum of care, have an essential role in helping children and their family/caregivers understand the importance of maintaining proper asthma control. This guideline focuses on the role of the nurse which includes the developmentally appropriate assessment, management, education, referral and follow-up of children with asthma.

Review Process

An expert panel was assembled for this review, comprised of members from the original development panel as well as other recommended individuals with particular expertise in this practice area. A structured evidence review based on the scope of the original guideline was conducted to capture relevant literature and other guidelines published since the original literature search. Findings regarding the impact of the current evidence base on the original guideline were summarized for the review panel. The review panel members were given a mandate to review the original guideline in light of the new evidence, specifically to ensure the validity, appropriateness and safety of the guideline recommendations as published in 2004. In November 2007, the panel met to achieve consensus on the impact of the new evidence on the existing recommendations.

RNAO Registered Nurses' Association of Ontario
L'Association des infirmières et infirmiers autorisés de l'Ontario
INTERNATIONAL AFFAIRS AND BEST PRACTICE GUIDELINES PROGRAMS

Review of Existing Guidelines

One individual searched an established list of websites for guidelines and other relevant content. This list was compiled based on existing knowledge of evidence-based practice websites and recommendations from the literature. Eight international guidelines were critically appraised by the panel using the Appraisal of Guidelines for Research and Evaluation (AGREE, 2001) Instrument. From this review, three high quality guidelines were identified to inform the review process and were circulated to all panel members:

Becker, A. et al. (2005). Summary of recommendations from the Canadian Asthma Consensus Guidelines, 2003 and Canadian Pediatric Asthma Consensus Guidelines, 2003 (updated to December 2004). *Canadian Medical Association Journal*, 173, S1-S56.

Global Initiative for Asthma (2006). Global strategy for asthma management and prevention. [Online]. Available: http://www.ginasthma.org

National Heart, Lung, and Blood Institute (2007). National asthma education and prevention program. Expert panel report 3: Guidelines for the diagnosis and management of asthma. [Online]. Available: http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm

Literature Review

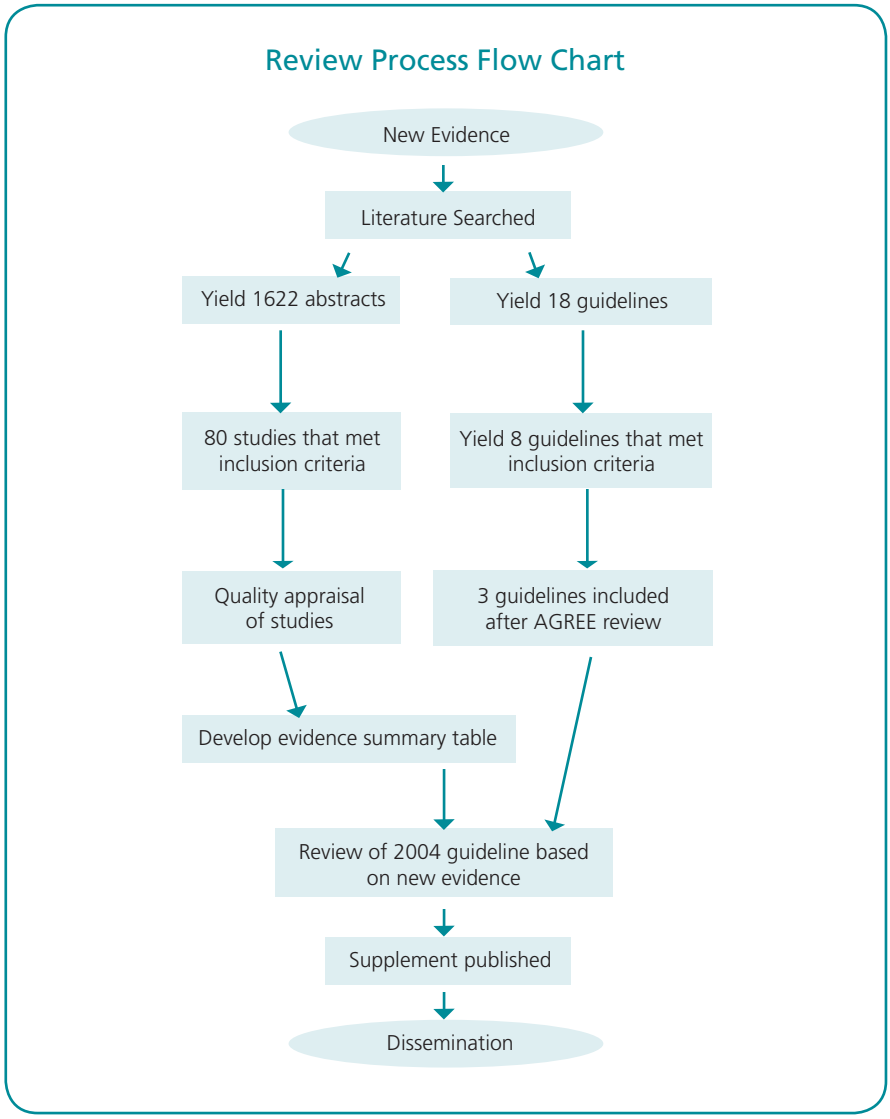
Concurrent with the review of existing guidelines, a search for recent research evidence relevant to the scope of the guideline was conducted with guidance from the Review Chair. The search of electronic databases, including CINAHL, Medline, Embase and ERIC, was completed by a health sciences librarian. A Master's prepared research assistant completed the inclusion/exclusion review, quality appraisal and data extraction of the retrieved studies, and summarized the literature findings. The comprehensive data tables and reference lists were provided to all panel members.

A summary of the evidence review is provided in the review process flow chart below:

Panel Review

After a review of the current evidence, it was the consensus of the panel that no substantive changes to the recommendations were required. However, the panel felt that updated supporting evidence, as well as recommendations addressing environmental tobacco smoke were necessary components to be included in the updated supplement. These updates have been incorporated into this document. The updated version of the guideline and other new implementation/evaluation resources identified by the panel are available on the RNAO website at www.RNAO.org/bestpractices.

Review Process Flow Chart



Summary of Evidence

A review of the most recent research evidence and relevant guidelines published since the development of the original guideline does not support the need for substantive changes to the recommendations. Through the review process, no recommendations have been deleted, however, some recommendations were re-worded for clarity or to reflect new evidence. New recommendations have been included in light of recent evidence related to smoking cessation and environmental tobacco smoke.

New Recommendations

The following table includes the new recommendations added by the panel:

Referral and Follow-up	Literature Supports
7.4 Nurses should advocate for no exposure to environmental tobacco smoke. ***(Level III)***	Annesi-Maesano et al., 2004; Becker et al., 2005; Cantani & Micera, 2005; Gilliland et al., 2006; Gilliland et al., 2003; GINA, 2006; Li et al., 2005; and NHLBI, 2007.
7.5 Nurses will refer youth or parents/caregivers to tobacco cessation programs, if indicated. ***(Level IV)***	NHLBI, 2007 and panel consensus.

Updates to Existing Recommendations

The following table includes the original recommendations with additional literature supports and/or modified wording:

Recommendation	Review Findings 2008
1.3 For children identified as potentially having uncontrolled asthma, the level of acuity needs to be assessed by the nurse and an appropriate medical referral provided (i.e., urgent care or follow-up appointment). ***(Level IV)***	Additional literature supports: Warke & Ennis, 2003.
4.0 Child/family knowledge of asthma should be assessed by the nurse at each patient contact. Asthma education should be provided when knowledge and skill gaps are identified. ***(Level 1a)***	The Canadian Asthma Consensus guideline recommends that education is an essential component of asthma therapy (Becker et al., 2006).
6.0 All children will have an individualized action plan for guided self-management based on the evaluation of symptoms, with or without peak flow measurements, developed in partnership with a health care professional. **(Level 1a)** 6.1 The action plan must be reviewed, revised and reinforced in partnership with the parent/caregiver, child and health care professional during every contact. The nurse will coach the parent to act as an advocate for their child, ensuring that the action plan is kept up to date. ***(Level 1a)***	Additional literature supports: Agrawal et al., 2005; Becker et al., 2005; Bhogal et al., 2006; Dinakar et al., 2004; GINA, 2006; and NHLBI, 2007.
9.3 Organizations need to plan and provide appropriate material resources to implement these best practice guidelines. Specifically, they must have: • placebos and spacer devices for teaching; • sample templates for action plan; • educational materials; • documentation tools; • resources for child/family and nurse education; • peak flow or other monitoring equipment, when indicated; and • in-patient materials/programs. ***(Level IV)***	It was the consensus of the panel that this recommendation be modified to include in-patient materials/programs as additional material resources.
12.0 Nurses should advocate for the promotion of optimal asthma care for children and families affected by asthma. ***(Level IV)***	It was the consensus of the panel that the wording of this recommendation be modified to emphasize the importance for nurses to advocate for the promotion of optimal asthma care. The change in the wording is for emphasis only and there has been no change in the intent of the recommendation.

Appendices

The review of this guideline did not identify a need for additional appendices; however, updates to the following appendices are noted.

Appendix G: Asthma Medications

Please note the metered dose inhaler, chlorofluorocarbon propelled MDI(CFC) device is no longer available in Canada. The medications table in this appendix (pg. 93-97 of the guideline) has been updated. For an updated list of asthma medications, please visit our website: www.RNAO.org/bestpractices.

Health Canada Drug Product Database (DPD)

The Health Canada DPD contains product specific information on drugs approved for use in Canada. The database is managed by Health Canada and includes human pharmaceutical and biological drugs, veterinary drugs and disinfectant products. It contains approximately 23,000 products which companies have notified Health Canada as being marketed.

To search individual drugs and health products available in Canada, please visit Health Canada: http://www.hc-sc.gc.ca/dhp-mps/index_e.html (click on Drug Products > Drug Product Database).

Appendix K: Child & Family Education/Nursing Professional Development

Additional resources have been added to this appendix to reflect the new focus in asthma education provided to clients on smoking cessation and the elimination of exposure to environmental tobacco smoke:

Resources for smoking cessation:

National

Canadian Cancer Society: www.cancer.ca

Canadian Council on Tobacco Control: www.cctc.ca

Health Canada: www.gosmokefree.ca

Heart and Stroke Foundation of Canada: www.heartandstroke.ca

Leave the Pack Behind: www.LeaveThePackBehind.org

Physicians for a Smoke-Free Canada: www.smoke-free.ca

Smoker's Helpline Online: www.smokershelpline.ca

Smoker's Helpline: 1-877-513-5333

The Lung Association: www.lung.ca

Training Enhancement in Applied Cessation Counselling and Health (TEACH): www.teachproject.ca

Provincial (Ontario)

Ontario Campaign for Action on Tobacco: www.ocat.org

Ontario Lung Association: www.on.lung.ca

Program Training and Consultation Centre: www.ptcc-cfc.on.ca

Tobacco Free RNAO: www.tobaccofreeRNAO.ca

Nursing Professional Development

The Asthma Educator Program at The Michener Institute for Applied Health Sciences is no longer available (pg. 116 of the guideline). Visit the Canadian Network for Asthma Care (CNAC) website, www.cnac.net, for a full listing of approved Asthma Educator programs.

Implementation/Evaluation Resources

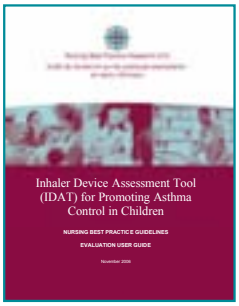
Resources have been developed to support the implementation and evaluation of the *Promoting Asthma Control in Children* guideline. Some of these resources include:

Educator's Resource: Implementation of Best Practice Guidelines - This resource has been developed to assist educators to incorporate guidelines into learning events in order to promote evidence-based practice to student nurses and faculty in academic settings, and to nurses in practice settings.

Toolkit: Implementation of Clinical Practice Guidelines – The Toolkit provides step-by-step directions to individuals and groups within health care settings involved in planning, coordinating, and facilitating guideline implementation. This resource was designed to accompany the RNAO's best practice guidelines, in order to support a planned approach to practice change.

Inhaler Device Assessment Tool (IDAT) for Promoting Asthma Control in Children – Evaluation User Guide - This user guide provides an overview of the development and psychometric properties of an evaluation tool considered as an indicator of patient outcomes targeted by the RNAO Best Practice Guideline on *Promoting Asthma Control in Children*. The IDAT is a checklist that nurses can use to ensure that the essential steps of inhaler device techniques are performed accurately and the delivery of medication is optimized. The IDAT lists critical steps applicable to several inhaler devices used by children. This resource can be downloaded at www.NBPRU.ca under "Resources".

Unless specified otherwise, these resources are available at www.RNAO.org/bestpractices for download.



For implementation/evaluation resources developed to support the uptake of this guideline, please visit the RNAO website at www.RNAO.org/bestpractices, or visit the Nursing Best Practice Research Unit website at www.NBPRU.ca.

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