Clinical Foundations

A Patient-focused Education Program for Respiratory Care Professionals

Free Continuing Education for Respiratory Therapists (CRCE)
See Page 12

www.clinicalfoundations.org

Visit Clinical Foundations online at www.clinicalfoundations.org
Archives • Free CRCEs

Asthma Exacerbations

Karen Gregory, MS, APRN-BC, RRT, AE-C

Asthma exacerbations are common in patients with uncontrolled asthma and carry a considerable burden of morbidity. Despite treatment guidelines by the National Asthma Education and Prevention Program (NAEPP) Expert Panel Report 3 (EPR-3) and the Global Initiative for Asthma (GINA), patients continue to experience uncontrolled asthma and thus are at increased risk for severe exacerbations. Asthma exacerbations can be caused by viral or bacterial infections, sinus disease, gastroesophageal reflux, and a host of other conditions. Genetic, prenatal and environmental factors all contribute to the risk of asthma and asthma exacerbations. Without proper management, asthma can lead to lung structural changes and permanent impairment. Effective control of asthma exacerbations starts with risk assessment to determine the appropriate treatments, and continues with patient education to ensure that treatment protocols are followed. The EPR-3 recommends a short-acting β-agonist as initial treatment for all patients, oxygen for most patients, with additional multiple doses of ipratropium bromide for patients who have severe exacerbations in the emergency department and systemic corticosteroids for most patients. Heliox-driven, nebulized albuterol is recommended for patients who have life-threatening exacerbations and for patients whose execration remains in the severe category after 1 hour of conventional treatment. Respiratory care practitioners play a major role in helping the patient learn the skills to achieve successful asthma control.

Panel Discussion: Asthma Exacerbation (AE) in the Hospital

Moderator: *Tim Op't Holt, EdD, RRT, AE-C*

Panelists: *Kathy Morris, DNP, ARNP*
Bill Galvin, MSEd, RRT
Catherine Kier, MD

Asthma exacerbations (AEs) often require hospital admission. In this panel discussion, 4 respiratory medicine experts were called upon to discuss various aspects of AE care in the hospital. Topics addressed include: what professionals are involved in hospital care of AEs, what type of protocol or flow of care is used in each expert's hospital, whether or not the protocol is consistent with EPR-3 recommendations and reasons for any variations, what data is collected in each institution for evaluating the effectiveness of the protocol, examples of success with individual protocols, and the teaching process patients for patients with AE.

2011-0003v1

This program is sponsored by Teleflex Medical Incorporated

Asthma Exacerbations

Karen Gregory, MS, APRN-BC, RRT, AE-C

Asthma is a complex, heterogeneous disease characterized by narrowing of the bronchial airways due to inflammation of the bronchi and contraction of the bronchial smooth muscle. Inflammatory components are significant to the pathogenesis of cough, dyspnea, and wheezing. The global prevalence of asthma is rising and represents a major impact on the health care system.[1] Asthma is a major health problem that affects nearly 300 million people or as many as an estimated 20% of children and 8% of adults worldwide. In the United States, asthma affects more than 22 million persons, including more than 6 million children.[2]

The burden of asthma exacerbations affects patients, their families, and society in terms of lost work and school, lessened quality of life, and avoidable emergency department (ED) visits, hospitalizations, and deaths. Improved knowledge of the manifestation of asthma exacerbations have led to significant improvements in asthma care. Despite optimal standard therapy according to the National Asthma Education and Prevention Program (NAEPP) Expert Panel Report 3 (EPR-3) and the Global Initiative for Asthma (GINA) guidelines, some patients continue to have uncontrolled asthma requiring frequent use of the health care system and are at risk of severe exacerbations.

Identification of Asthma Exacerbations

The American Thoracic Society (ATS) and European Respiratory Society (ERS) Task Force were established to provide recommendations identifying the assessment of asthma in clinical trials and clinical practice.[3] According to the Task Force, exacerbations are identified as events characterized by a change from the patient's previous status. Severe asthma exacerbations are defined as events that require urgent action by the patient and physician to prevent a serious outcome such as hospitalization or death from asthma.[3] Moderate asthma exacerbations are defined as events that are troublesome to the patient, and prompt a need for a change in treatment, but that are not severe.

Factors Associated with an Asthma Exacerbation

An asthma exacerbation is characterized by intermittent periods during which asthma symptoms are increased and requires intervention of medical management. Exacerbations requiring medical interventions result in significant cost for healthcare resources and affect quality of life for the patient and family.[4] Asthma comprises a range of heterogeneous phenotypes that differ in presentation, etiology, and pathophysiology. The patterns of airway inflammation differ according to the trigger factor responsible for exacerbation.[5] Respiratory viral infection, primarily rhinovirus, tends to be the main factor associated with an asthma exacerbation. Asthma exacerbation may also be caused by atypical bacteria. *Chlamydophila pneumoniae*, an intracellular respiratory pathogen, has been linked to asthma exacerbation in children.[6] Factors primarily associated with frequent exacerbations include recurrent respiratory infections, sinus disease, gastroesophageal reflux, psychological dysfunction, allergens, irritants, environmental factors, exercise, medications, and obstructive sleep apnea. Furthermore, asthma exacerbations are a strong risk factor of future exacerbations.

Populations at increased risk during for an asthma exacerbation include patients with 1 or more risk factors for asthma-related deaths (Figure 1).[7] Although wheezing is common in the first 3 years of life, only a fraction of all infants with wheeze will go on to develop childhood asthma.[8] Prenatal risk factors are an important predictor of future asthma exacerbations and may include diet and nutrition, stress, use of antibiotics and various environmental exposures may affect the early development of allergy and asthma. In utero, smoke (IUS) exposure has been associated with increased prevalence of asthma and reduced lung function in healthy children.[9]

Family history of asthma frequently occurs, though is not necessary for the development of asthma. Genetic research has recently integrated environmental and genetic factors to investigate the relationship. Although genetic predisposition is clearly evident, interaction with the environment probably explains the variation in prevalence rates for allergy and asthma. Different levels of environmental exposures may increase or decrease risk depending on the genotype.[10] The risk factors for each recognized phenotype of asthma

Figure 1. **Risk factors for death from asthma**

- Asthma history
- Previous severe exacerbation (e.g., intubation or ICU admission for asthma)
- 2 or more hospitalizations for asthma in the past year
- 3 or more ED visits for asthma in the past year
- Hospitalization or ED visit for asthma in the past month
- Using >2 canisters of SABA per month
- Difficulty perceiving asthma symptoms or severity of exacerbations

Other risk factors

- Lack of a written asthma action plan
- Sensitivity to *Alternaria*
- Social history
- Low socioeconomic status or inner-city residence
- Illicit drug use
- Major psychosocial problems
- Comorbidities
- Cardiovascular disease
- Other chronic lung disease
- Chronic psychiatric disease

include genetic, environmental, and host factors. Genetic polymorphisms are associated with asthma severity. Potential asthma-susceptibility genes or complexes have been identified using a positional approach.[11]

The literature reveals continuing abnormalities in lung function and the presence of airway inflammation as symptoms improve are consistent with ongoing effects of asthma that could easily predispose to adult obstructive lung disease.[11] Airway inflammation plays a key role in lower airway response in asthma exacerbations and occurs together with airflow obstruction and increased airway responsiveness. Sputum eosinophilia develops weeks before an asthma exacerbation. Increase of sputum eosinophilia often is comparable to the increase of asthma symptoms. The availability of monitoring airway inflammation by measuring cell counts in induced sputum has indicated significant heterogeneity and changing patterns of inflammation during an exacerbation and periods of unstable or poorly controlled asthma.[12]

Exacerbation Effect on Lung Function

Effects of asthma exacerbations are best assessed by pulmonary function testing and used as an indicator of progressive decline. Irreversible airflow obstruction or limitation occur in some patients with asthma and tend to be more common as asthma becomes more severe. Results from large studies evaluating the decline of forced expiratory volume in one second (FEV_1) suggest that asthma has a significant impact on lung function decline, although not as great as COPD. Cibella and colleagues observed that lung function decline in bronchial asthma is significantly influenced by age, disease duration, and FEV_1 variability.[13]

The START Study (Inhaled Steroid Treatment as Regular Therapy) examined the effects of exacerbation on lung function, and demonstrated that early intervention with inhaled budesonide within the first 2 years of asthma diagnosis in patients with persistent asthma improved pre-bronchodilator and post-bronchodilator FEV_1.[14] Early interventions with inhaled corticosteroids demonstrated their benefits, including less need for medication to achieve asthma control.

Asthma may lead to structural changes and permanent impairment. Inflammatory mediators induced by viral infections could adversely affect lung development. Airway remodeling may be present in early infancy or childhood and may represent a risk factor for the persistence of symptoms and development of asthma.[15] Airway inflammation and airway remodeling are thought to contribute to disease progression over time, although few longitudinal studies support this paradigm.

Figure 2. **Asthma may be classified based on the history of frequency and severity of exacerbations.**

Mild intermittent asthma
- Symptoms of cough, wheeze, chest tightness, or difficulty breathing less than twice a week
- Flare-ups brief, but intensity may vary
- Nighttime symptoms less than twice a month
- No symptoms between flare-ups
- Lung function test FEV_1 ≥80% of normal values
- Peak flow less than 20% variability AM-to-AM or AM-to-PM, day-to-day.

Mild persistent asthma
- Symptoms of cough, wheeze, chest tightness, or difficulty breathing 3-6 times a week
- Flare-ups may affect activity level
- Night-time symptoms 3-4 times a month
- Lung function test FEV_1 ≥80% of normal values
- Peak flow less than 20-30% variability

Moderate persistent asthma
- Symptoms of cough, wheeze, chest tightness, or difficulty breathing daily
- Flare-ups may affect activity level
- Night-time symptoms 5 or more times a month
- Lung function test FEV_1 >60% but <80% of normal values
- Peak flow more than 30% variability

Severe persistent asthma
- Symptoms of cough, wheeze, chest tightness, or difficulty breathing continual
- Nighttime symptoms frequently
- Lung function test FEV_1 ≤60% of normal values
- Peak flow more than 30% variability

Exacerbation Components of Impairment and Risk

The EPR-3 Guidelines identify current impairment and future risk as the 2 domains for asthma severity and asthma control.[2] Impairment refers to frequency and intensity of symptoms, use of short-acting β-agonists, functional limitations, pulmonary function values and quality of life. Risk represents a more longitudinal feature of asthma that includes exacerbations, progressive loss of lung function, and adverse effects from medication. Risk examines the probability of asthma exacerbations, progressive decline in lung function, reduced lung growth in children, or risk of adverse effects from medication.

Assessment of recent and current asthma impairment includes assessing daytime and nighttime asthma symptoms, frequency of short-acting β-agonist use, lung function, tolerated activity levels, quality of life, and satisfaction with the partnership and asthma care provided by the respiratory therapist, asthma educator, and health care team. Assessment of current and future asthma risk is the estimate of the likelihood of an exacerbation as it relates to the patient's past medical history and current asthma disposition, progressive loss of lung function over time, reduced lung growth in children, adverse events from medications, or asthma death.

Asthma control is the degree to which the manifestations of asthma are minimized by therapeutic intervention and the achieved goals of therapy. Asthma severity is a measure of intrinsic intensity of the disease process and can be measured most readily and directly in patients not receiving long-term control therapy.[2] Responsiveness is defined as the ease in which control is achieved by medical therapy. Impairment and risk must be assessed and monitored when devising a medical treatment regimen to achieve optimal control. Assessment of severity is used to initiate therapy and assess control to

adjust therapy.

Asthma severity is classified according to symptomology, objective measures, and family history. Severity classifications include mild intermittent, mild persistent, moderate persistent or severe persistent (Figure 2). EPR-3 now factors in the forced vital capacity (FVC) and use the FEV_1/FVC ratio as a spirometric criterion for classifying asthma. In addition, EPR-3 recommends pre-bronchodilator and post-bronchodilator spirometry in children 5 years of age or older to serve as a component of determining diagnosis, severity classification, and assessing asthma control. Asthma control is the degree to which the manifestations are minimized and the goals of therapy are achieved. When asthma control is achieved for at least 3 months, treatment can be stepped down to achieve the best control.

Assessing longitudinal clinical information required to determine asthma control prevents inconsistency and variability in clinical decision making. The Asthma Control Test (ACT) is a clinically validated patient assessment tool for children and adults, designed to supplement the medical history. The questionnaire contains 5 items referencing events over 4 weeks. Questions assess the number of missed school or work days, dyspnea frequency, β-agonist requirements, nocturnal awakenings, and self assessment of asthma control (http://www.asthmacontrol.com).A score or 19 or greater reflects controlled asthma.

Hospital Management

Most asthma exacerbations are managed in a clinic or outpatient setting, while more severe exacerbations may require an emergency room or hospital admission to regain control. Factors predicting severe deterioration warranting hospital admission include chronic severity with impaired lung function, poorly controlled chronic asthma with co-morbidities, psychosocial factors, and non-adherence with treatment. The Expert Panel recommends a short-acting β-agonist as initial treatment for all patients, oxygen for most patients, with additional multiple doses of ipratropium bromide for patients who have severe exacerbations in the emergency department (Ipratropium bromide is not recommended during hospitalization for asthma), and systemic corticosteroids for most patients. Respiratory failure can rapidly progress and is difficult to reverse. Signs of impending respiratory failure include an inability to speak, altered mental status, intercostal retraction, worsening fatigue, and a $PaCO_2$ of 42 mm Hg or greater.[7]

Respiratory care practitioners are very proficient asthma educators. Patient education is a key component to achieving successful asthma management for patients of all ages. Asthma education opportunities arise during the hospital admission in efforts to decrease future exacerbations. Patient adherence and technique in administering medications correctly and identifying factors that decrease control should be assessed.[1,2]

Heliox

The EPR-3 recommends consideration of heliox-driven, nebulized albuterol for patients who have life-threatening exacerbations and for patients whose execration remains in the severe category after one hour of conventional treatment. Heliox consists of helium and oxygen (60:40, 70:30, or 80:20), a mixture that is lighter and less dense than oxygen. The lower density of heliox results in a lower propensity for gas flow to become transitionally or fully turbulent.[16] Turbulent flow results in higher flow resistance, and turbulence patterns may adversely affect aerosol deposition within the airways and lungs. The use of heliox as a driving gas has been shown to affect the size and output rate of nebulized aerosols when compared with air or oxygen.[17]

Figure 3. **When to Refer to an Asthma Specialist?**

- History of a life-threatening asthma exacerbation (hospitalization is a risk factor for mortality)
- Required > 2 bursts of oral corticosteroids in 1 year
- Requires "Step 4" care or higher care ("Step 3" for children 0–4 years of age).
- Patient is not meeting the goals of therapy after 3-6 months
- Co-morbid conditions complicate asthma (GERD, VCD, etc)
- Additional diagnostic studies are indicated (allergy skin testing, pulmonary function studies, bronchoscopy)

Treatment of acute asthma is based on reversing airway constriction and inflammation. The use of heliox to administer aerosolized medication delivery may optimize β-agonist therapy for patients with asthma exacerbations. The restricted gas flow through the constricted airways positions heliox as a potential adjunctive treatment for pediatric asthma.[17] Greater results in increased FEV_1 have been reported, likely because of better drug delivery to the distal airways.[18] Studies have demonstrated better responses in patients treated with continuous nebulization compared to intermittent treatment. In a prospective, randomized single-blinded study of children with moderate-to-severe asthma exacerbations, continuous nebulized albuterol delivered by heliox was associated with a greater degree of clinical improvement compared with albuterol delivered by oxygen.[16] Several studies reported varying results in the utility of heliox in acute asthma. Rodrigo et al. reviewed 10 randomized controlled trials (n=544) comparing heliox to placebo in combination with standard treatments for acute asthma and concluded that the evidence does not support routine use of heliox in patients with acute asthma.[18] Kim et al. argue that this review focused on the use of heliox alone and primarily in adults, not on the use of heliox as a driving gas for nebulized β-agonist therapy.[16] According to Myers, it appears reasonable for the clinic to consider heliox as a relatively safe "therapeutic bridge" for disease that causes airflow obstruction and increases turbulence.[17] This approach may allow more time for better

planning of respiratory support, onset of action of medications, or the natural resolution of a disease process.

Prevention Strategies

Early treatment of asthma symptoms is the best strategy to achieve successful management. Asthma education should begin at diagnosis and be reinforced at each visit to the clinic, emergency department, hospital, and pharmacy, and it should involve all members of the healthcare team. Essential prevention strategies include a written asthma action plan, recognition of early signs and symptoms of worsening asthma, increasing the use of short-acting β-agonists, adding a short course of oral corticosteroids as appropriate, removal of factors contributing to the exacerbation, and prompt communication between the patient, the respiratory care practitioner, and other healthcare providers. Personal asthma action plans help individuals adjust to their treatment in response to changes in their level of asthma control, as indicated by symptoms and/or peak expiratory flow, in accordance with written predetermined guidelines.

Asthma education is an essential component of asthma therapy. EPR-3 confirms the importance of teaching patients how to implement asthma management and use a written asthma action plan. Asthma management guidelines recommend long-term treatment with inhaled corticosteroids to attenuate the chronic airway inflammation of persistent asthma. Identification of asthma triggers significantly reduced the risk of asthma exacerbations. Recommendations for asthma management and prevention strategies include the following major goals: 1) achieve and maintain control of symptoms; 2) maintain normal activity levels, including exercise; 3) maintain pulmonary function as close to normal as possible; 4) prevent asthma exacerbations; 5) avoid adverse effects from asthma medications; and 6) prevent asthma mortality and morbidity. Patients who are at high risk for asthma-related death require special attention, particularly intensive education, monitoring, and care.[2] Referral to an asthma specialist is advised for consultation in complex cases and has been shown to reduce the risk of increased mortality. (Figure 3).

Conclusion

Asthma is a multifaceted disease with variation in response to treatment. Asthma exacerbations are considered a risk factor for future exacerbations and require assessment of triggers, history of exacerbations, exposure to allergens, adherence to prescribed medications, atopic characteristics, and preventive measures to reduce future risk. Poor asthma control results from the inability to recognize asthma symptoms, improper inhaler technique, environmental allergen exposure, fear of adverse medication reactions, lack of patient education, non-adherence, cost of medications, poor access to health care, and no written asthma action plan.[2] Respiratory care practitioners play a major role in helping the patient learn the skills to achieve successful asthma control.

1. GINA, 2009 Global Initiative for Asthma. 2009 Update: Workshop Report, Global Strategy for Asthma Management and Prevention. Available at: http://www.ginaasthma.com.
2. National Asthma Education and Prevention Program Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Rockville, MD. National Heart, Lung, and Blood Institute, US Dept of Health and Human Services; 2007. NIH publications 08-4051.
3. Reddel HK, Taylor ER, Bateman ED, Boulet LP, Boushey HA, Busse WW. An official American Thoracic Society/ European Respiratory Society statement: Asthma control and exacerbations: Standardizing endpoints for clinical asthma trials and clinical practice. Am J Respir Crit Care Med 2009;180:59–99.
4. Colice GL. Facing the challenge of unmet needs in asthma. Ann Allergy Asthma Immunol 2007;98(2 Suppl 2):S16-22.
5. Wark PA, Gibson PG. Asthma exacerbations. 3: Pathogenesis. Thorax. 2006;61(10):909-15.
6. Cunningham AF, Johnston SL, Julious SA, Lampe FC, Ward ME. Chronic Chlamydia pneumoniae infection and asthma exacerbations in children. Eur Respir J 1998;11:345–349.
7. Camargo CA, Rachelefsky G. Schatz M. Managing Asthma Exacerbations in the Emergency Department: Summary of the National Asthma Education and Prevention Program Expert Panel Report 3 Guidelines for the Management of Asthma Exacerbations. J Emerg Med 2009;(2 Suppl 1):S6-S17.
8. Delacourt C, Benoist MR, Waernessyckle S, et al. Relationship between bronchial responsiveness and clinical evolution in infants who wheeze: A 4-year prospective study. Am J Respir Crit Care Med 2001;164:1382-6.
9. Cohen RT, Raby BA, Steen KV, et al. In utero smoke exposure and impaired response to inhaled corticosteroids in children with asthma. J Allergy Clin Imunol 2010;126:491-497.
10. Strunk RC, Weis ST, Yates, KP, Tonascia J, Zeiger RS, Szefler SJ. Mild to moderate asthma affects lung growth in children and adolescents J Allergy Clin Immunol 2006;118:1040-7.
11. Restrepo RD, Peters, J. Near-fatal asthma: Recognition and management: risk factors. Curr Opin Pulm Med 2008;14(1):13-23.
12. Sears MR. Epidemiology of asthma exacerbations. J Allergy Clin Immunol 2008;122(4):662-668.
13. Cibella F, Cuttitta G, Bellia V, et al. Lung function decline in bronchial asthma. Chest 2002;122(6):1944-8.
14. Busse WW, Pedersen S, Pauwels RA, et al. The Inhaled Steroid Treatment As Regular Therapy in Early Asthma (START) study 5-year follow-up: effectiveness of early intervention with budesonide in mild persistent asthma. J Allergy Clin Immunol 2008;121(5):1167-74.
15. Roy SR, Milgram H. Management of acute exacerbation of asthma. J Asthma 2003;40(6); 593-604.
16. Kim IK, Phrampus E, Venkataraman S, et al. Helium/oxygen-driven albuterol nebulization in the treatment of children with moderate to severe asthma exacerbations: a randomized, controlled trial. Pediatrics 2005;116(5):1127-33.
17. Myers TR. Use of heliox in children. Respiratory Care 2006;51(6):619-631.
18. Rodrigo GJ, Pollack CV, Rodrigo C, Rowe BH. Heliox for non-intubated acute asthma patients. Cochrane Database of Systematic Reviews 2006, Issue 4. Art. No.: CD002884.

Karen Gregory, MS,APRN-BC, RRT, AE-C is an acute care clinical nurse specialist with a specialty in asthma, allergy and pulmonary medicine. She is also a registered respiratory therapist and certified asthma educator. Ms Gregory obtained her undergraduate and graduate degrees from the University of Oklahoma Health Science Center. Her degree in Respiratory Therapy was obtained from Rose State College. She currently works at the Oklahoma Allergy and Asthma as an Advanced Practice Nurse and Asthma Educator, as well as teaching research at the University of Oklahoma College of Nursing. Ms. Gregory is president of the Association of Asthma Educators and serves as a faculty member of the American Association for Respiratory Care Asthma Preparatory Course. Throughout her career she has held active memberships and leadership positions in her professional organizations serving on boards, committees, and projects including assisting with the establishment of two professional organizations. Research projects include on quality of life, adherence, and asthma management in the rural setting for the adult and pediatric population with asthma.

Panel Discussion; Asthma Exacerbation in the Hospital

Moderator:
Tim Op't Holt, *EdD, RRT, AE-C*

Panelists:
Kathy Morris, *DNP, ARNP*
Bill Galvin, *MSEd, RRT, AE-C*
Catherine Kier, *MD*

In this module of *Clinical Foundations*, three health care providers: a respiratory therapy educator, a pediatric pulmonary physician and a nurse practitioner provide their insights on caring for patients who have an asthma exacerbation (AE). They were asked to respond to a list of questions that addressed who cares for patients with AE in the ED, the protocol for their care, if their protocol is consistent with the EPR-3, the evaluation of their protocol and the type of data being collected, examples of the use of their protocol, and the nature of the teaching process. You will learn that physicians, respiratory therapists and nurses work together to care for those with AE, there are a variety of processes in use and in development, and that patients and staff benefit from an evidence-based protocol.

> My experience is that acute exacerbations for asthma entail a team approach.
>
> - Galvin -

In your hospital, what professionals are involved with direct care of the patient with asthma exacerbation (AE) ?

Galvin: My experience is that acute exacerbations for asthma entail a team approach. The team consists of the primary care physician (PCP); the staff nurse (RN); the respiratory therapist (RT); other caregivers and the patient. Each party has a specific role to play – the PCP oversees all aspects of the patient's condition and provides primary direction regarding appropriate care. The PCP has the depth and breadth of knowledge to serve as the generalist - providing expertise on the acute exacerbation of the asthmatic episode as well as continuous, on-going and long-term care of the patient. Additionally, the PCP has in-depth knowledge of all the organs and how asthma impacts on other parts of the body.

The nurse functions on a similar basis with a view to oversight on a more immediate basis. The nurse will monitor and assess the patient on a regular, day-to-day, moment-by-moment basis and will be aware of acute changes in the patient's condition.

The RT will generally assess the patient's respiratory status and has primary responsibility for the diagnostic and therapeutic aspects of pulmonary care. Respiratory therapists are specialists in cardiorespiratory conditions and as such are trained on all aspects of these two organ systems. Pulmonary function testing has become a specialty area that requires not only an understanding of lung volumes, capacities and flow studies but also the physical and mechanical aspects of the technology employed to perform such tests. Additionally, drug delivery systems, such as small volume nebulizers (SVN), pressurized metered dose inhalers (pMDI) and dry powder inhalers (DPI), have become increasingly more complex, and their different capabilities must be understood by those involved in asthma management. Respiratory therapists are trained and educated on the optimal use of such devices.

The patient and/or caregiver is obviously central in the care and management of asthma. Updated versions of the NAEPP-EPR guidelines have all emphasized establishing a partnership between the caregiver and the patient. Passivity and noninvolvement of the patient is no longer acceptable in the effective management of asthma. The patient must assume a degree of responsibility for their condition and be an active participant in their care. This partnership encompasses all aspects of patient education from assessment, control of precipitating factors, implementation of scientifically accepted standards of care, and the effectiveness of the intervention. The patient must be empowered to assume near complete control and management of their condition. Asthma is a condition that cannot be cured, but it can be controlled and the patient is the primary person responsible for their condition.

Additionally and as noted in the opening line, we must remember that effec-

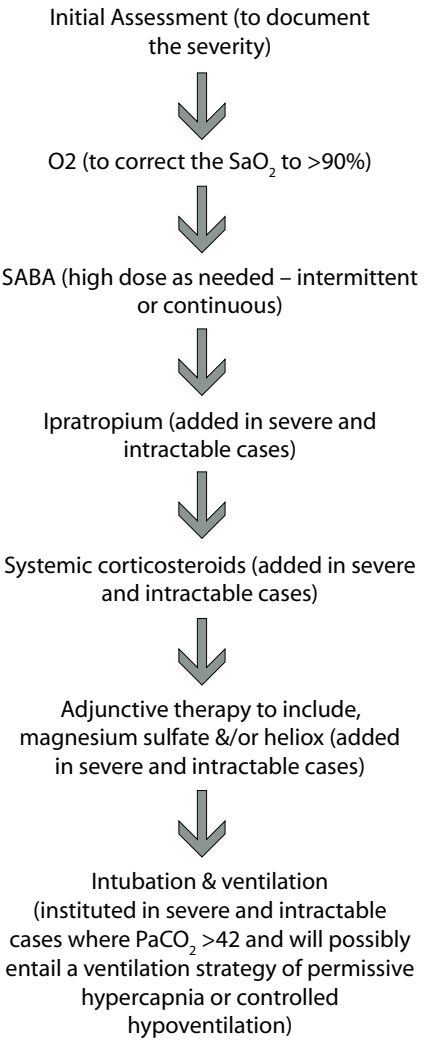
tive asthma care and management entails a team approach where all parties have a role and responsibility. We need to be working in harmony and unison with each other.

Kier: In our emergency department (ED), the following are involved in care: ED physicians – including attending physicians who make the final disposition for the patient – house staff, nurses – and specifically a nurse educator who is a member of our Asthma Initiative Committee – respiratory therapists, and social workers. When the patient with AE is admitted to hospital, the following people are involved: physicians, including hospitalists, asthma specialists, ICU specialists, house staff, nurse practitioners, nurses, nurse educators, respiratory therapists, social workers, case managers and discharge planners.

Morris: The ED where I work most frequently is located in a suburban area and averages between 70 to 100 visits a day. The nurse, respiratory therapist, and the healthcare practitionier –Physician, PA or NP – are involved in the treatment of patients who present with an AE. Sometimes pharmacy is involved depending on the medications used, such as steroids or magnesium. The respiratory therapist administers the nebulizer treatments. Peak flow or FEV_1 measurements are not done prior to or during the asthma exacerbation. When a patient arrives in the ED, the nurse may start an albuterol treatment as a preemptive order if they are having moderate to severe respiratory distress.

Briefly describe the protocol or flow of care for the patient with AE. Is there anything you would change in your protocol?

Galvin: Teaching respiratory care in an academic setting affords me the opportunity to follow the protocols documented in the literature, specifically the guidelines provided by the National Heart, Lung, and Blood Institute: The National Asthma Education and Prevention Program-Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma (NAEPP-EPR-3). We inform the students that the protocols they will see are those developed at the affiliate clinical sites. While we have found that they are all quite similar, we emphasize that the NAEPP-EPR3 report is the gold standard with regard to the care and management of asthma. The algorithm is available in the report but an abbreviated and more general account of the action steps is as follows:



Kier: Once identified with asthma, the patient is managed following the asthma protocol developed by our Asthma Initiative Committee. These patients follow the asthma protocol in the ED, on the floors and in the ICU's. Using the asthma flow sheet, the respiratory therapist can advance or maintain the current bronchodilator schedule, and communicate regularly with the nurses, house staff and hospitalists/ED physicians. The asthma protocol includes all the parameters in the benchmark for asthma care: assessment of respiratory severity score, use of bronchodilators, use of systemic steroids, assessment of asthma severity and asthma control classification, and a home management care plan.

Included in the asthma education are: appropriate treatment with daily anti-inflammatory medications, delivery device teaching, identification of triggers (including smoke exposure), avoidance of triggers, smoking cessation and a reminder for the annual influenza vaccination. Social worker and discharge planners are involved. Nebulizer machines and delivery devices are arranged to be delivered at home, or even provided to the patient prior to discharge, as their healthcare benefits permit.

A concise one page summary of the protocol (with a checklist) is provided in the patient's chart which would serve as a guide to the healthcare professionals caring for the patient. Discharge orders are coordinated by the house staff and the discharge nurse. The Asthma Action Plan is given upon discharge. There is documentation of follow-up with the primary provider and referral to the asthma specialist if needed. Home care visits are also arranged if needed. The discharge nurse reviews the Asthma Action Plan in detail with the patient or caregiver. Both the discharge nurse and the patient/caregiver sign the Asthma Action Plan (which is in triplicate). The original copy goes with the patient/caregiver. The second copy stays in the patient's chart, and the third copy goes to the hospital committee to be used in data collection for our database.

There is nothing to be changed in our

current protocol for now. There are no major revisions but we continue to PDSA (plan-do-study-act) the process, and we update the protocol periodically.

Morris: There is no standard protocol for the treatment of acute AE in the ED where I work. There is a standing order sheet that is available to be used by providers if they are admitting the patient to the hospital. The order sheet does not require peak flow or FEV1 assessment. It does require O_2 saturation and respiratory rate and effort to be documented during evaluation. It does not make any recommendations regarding types of nebulized medications or number of treatments. It is basically just an order sheet for the providers to check off what medications to administer after the patient is admitted. There are a few items that need change.The order sheet format is not useful for directing evidence-based care for the patient with an acute AE. Utilizing the EPR-3 algorithm with decision points would be more conducive for standardized care. Another option would be to develop an ED order sheet based on the EPR-3 recommendations for AE.

Is your protocol consistent with the protocol in the EPR-3?

Galvin: Our protocol is exactly that of the NAEPP-EPR3. Our experience is that virtually all of the institutions affiliated with our program adhere closely with the guidelines. However, there is some variation.

Kier: Yes, our asthma protocol was revised according to the EPR-3 guidelines.

Morris: No, there is no protocol or algorithm in place. The order sheet used for admission does not reference the EPR-3 guidelines. The treatment plan is dependent upon each provider's preference in asthma medications and treatments. This leads to inconsistent care in the treatment of acute asthma exacerbations not only in the ED but also in the decision-making process for admission to hospital.

The guidelines were developed by a panel of experts and have a high degree of scientific evidence supporting their conclusions and recommendations.

- Galvin -

Why did your protocol-writing committee choose to be consistent or inconsistent with EPR-3 guidelines?

Galvin: Our respiratory care curriculum is written and developed by our faculty with guidance and advice from our medical director. The program faculty attends professional meetings and periodically performs a review of the literature to assure the curriculum is state-of-the-art. We adopt and follow the NAEPP-EPR-3 guidelines. The guidelines were developed by a panel of experts and have a high degree of scientific evidence supporting their conclusions and recommendations. In order to be accepted as "state-of-the-art" they have to satisfy a high degree of rigor and scientific evidence.

Kier: The EPR-3 guidelines incorporate an update for asthma diagnosis and management based on expert consensus. These experts have meticulously reviewed the available recent data. Asthma research and scientific literature related to asthma have been enhanced in recent years. There has been a lot of interest and increased funding for research especially related to asthma in the younger population.

In addition, apart from advances in science and research, the EPR-3 guidelines have incorporated a partnership between the healthcare providers and the patient/caregiver. Introduction of the concept of "asthma control" in the EPR-3 guidelines provides: (1) better communication and better understanding of asthma care, (2) empowerment (and a sense of responsibility) of the patient/caregiver, (3) practical tools for assessing asthma control, such as the Asthma Control Test (ACT), Asthma Control Questionnaire (ACQ) and the Asthma Therapy Assessment Questionnaire (ATA) for children or adults, and (4) patient/caregiver education with avoidance of environmental triggers, smoking cessation, and influenza immunization annually.

Morris: As I've noted, there is no protocol in place where I work. However, the protocol writing committee of the health system does follow evidence-based guidelines and has a history of utilizing system experts to develop these types of products. There are already pathways or protocols in place for pneumonia, congestive heart failure and myocardial infarctions, however, those pathways are tied to core measures and reimbursement.

Are you collecting data to evaluate the effectiveness of your protocol to accomplish some clinical or health care outcomes? If so, what data are you collecting?

Galvin: Being at an academic center with primary responsibility for teaching protocols, we do not get directly involved in evaluating the effectiveness of protocols.

Kier: Yes, we use the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) asthma performance measures. The three measures are: (1)

use of relievers for inpatient asthma, (2) use of systemic corticosteroids for inpatient asthma, (3) home management plan of care given to patient/caregiver.
As part of our quality improvement measures, we are working with our clinical informatics department to develop a prompt or alert on our electronic medical record. The patient would be identified by the alert if there is a diagnosis of asthma on admission to the ED or the hospital. This alert will be a prompt for the provider to initiate and document asthma education.

Morris: I am currently starting a research project to evaluate if the rural hospitals in my state are using a protocol. After evaluating the survey, a program will be developed to educate ED nurses on the EPR-3 guidelines and to develop a protocol flow-sheet for patients with AE for use in the ED. Recently, there has been more literature regarding studies on the treatment of AE in the ED. Olajos-Clow et al studied Healthcare Providers' attitudes towards implementation of an asthma pathway.[1] This particular study involved 5 EDs in Canada over a 6-month period during the implementation of an ED Asthma Care Pathway. The conclusion was that healthcare providers felt the use of a standardized pathway improved both awareness and adherence to best practice when treating the AE in the ED.

Can you cite a case where you can really see positive outcomes of your protocol for AE?

Galvin: While a real patient case involving direct patient contact and care is not within the purview of the college setting, we do use simulation technology and share stories and examples of patient conditions related to asthma exacerbations. Our students are exposed to simulators that mimic an asthma condition and are required to assess breath sounds recorded within the mannequin. The resultant intervention is to demonstrate appropriate care via information gathering and clinical decision-making. Of particular note is the assembly and proper use of metered dose inhaler, dry powdered inhalers and aerosolized updraft nebulizers. The students are required to demonstrate competency through the check-off and evaluation form. This also involves computerized simulated case studies entailing symptom recognition, monitoring, administration of bronchodilator therapy and follow up assessment and care.

The three measures are: (1) use of relievers for inpatient asthma, (2) use of systemic corticosteroids for inpatient asthma, (3) home management plan of care given to patient/caregiver.

Kier: There are many individual cases that I could cite where positive outcomes of our protocol for AE are evident. A specific case I clearly remember was that of a Hispanic girl who had been through a number of ED visits and asthma hospitalizations in her nearby community hospital. During one of her admissions, she was transported to our institution for further management. Even with the language barrier, through the assistance of our in-house interpreter, she and her family underwent asthma education with a documented asthma management plan. She was started on daily anti-inflammatory medications for asthma control. On a follow-up phone call a few months later, she had not returned to the ED or been hospitalized for acute asthma exacerbation.

From a broader standpoint, the most positive outcome of our asthma protocol for AE is sharing our created protocol, process and success to nearby healthcare organizations, and a number of hospitals in Long Island, New York, followed by implementing their own protocol for AE. This was successful through our regional coalition, the Asthma Coalition of Long Island. Members of our asthma coalition are comprised of volunteers of medical and public health professionals, schools, business and government agency leaders, community activists and others dedicated to asthma care.

Morris: I can recall numerous cases where a protocol would be beneficial, especially when the ED is busy so that the nurse could implement the pathway. Also, the use of peak flows would provide objective data when deciding on whether to dismiss a patient or admit them as an inpatient. Recently, while working in a critical access hospital in a rural area, we had a patient not adherent with his asthma medications come to the ED at 2:00 am. He had visited the ED twice in the 2 months prior, both times with AE. I consulted the EPR-3 guideline for the management of AE in the ED. The guidelines assisted my decision-making process by providing an evidence-based recommendation to admit the patient to hospital for an incomplete response to medical treatment. The guidelines also promoted staff education, so I worked with the nurses to provide a better understanding of the treatment of asthma exacerbation while I was treating the patient.

Describe the teaching process that is implemented in the ED for patients with AE, or is the patient referred to the healthcare provider's office?

Galvin: As noted, our curriculum en-

tails classroom lectures on the patient education process. We stress to our students that patient education is central to the care and management of the asthmatic and that it consist of 4 distinct components - assessment, planning, implementation, and evaluation. Each of these areas is discussed in considerable detail with particular emphasis on addressing each component and not simply telling the patient about their disease. An abbreviated version of this 4-component process is suggested for patients in the ED that are discharged home as a result of a positive response to care. A more detailed and comprehensive coverage of these 4 components is recommended for the patient when they are referred to their primary care physicians (PCP) for follow up care. A brief account of the 4-component process noted above is addressed below.

In our teaching of the assessment component, we stress both clinical assessment as well as diagnostic assessment. The clinical assessment entails identifying the presence of the following signs and symptoms: increased respiratory rate, use of accessory muscles, wheeze, increased pulse, presence of pulsus paradoxus, breathlessness, ability to talk in sentences versus phrases versus words, and alertness (NAEPP-EPR-3). The diagnostic assessment entails FEV_1 or PEF determination as well as a decrease in PaO_2 or SaO_2, and/or an elevation in $PaCO_2$. The percentage of each determines the level of severity and the suggested therapeutic intervention (NAEPP-EPR-3).

The planning component entails development of a tailor-made, written action plan where specific goals and objectives are identified and discussed with the patient. It is critical that the action plan be mutually developed and tailored to the patient. Additionally, evidence indicates that a written action plan is 4 times more effective in lowering the risk of death from asthma then a verbal action plan.[2] Written action plans should contain four essential elements: when to increase therapy, how to increase therapy, the duration of increased therapy and the point at which to cease self-management and seek medical help.[3] A template of an action plan is readily available from the guidelines as well as numerous credible professional societies and organizations, such as the American Lung Association, the American College of Chest Physicians, and the American Thoracic Society.

> I can recall numerous cases where a protocol would be beneficial, especially when the ED is busy so that the nurse could implement the pathway.
>
> - Morris -

The third component we address with our students is implementation, and here we briefly address the learning process. We try to impress on our students that patients learn differently and thus we emphasize the different learning styles, the principles of learning, and the different learning domains. The key points are to address the visual, auditory and tactile learner, noting that multiple sense learning is most effective. Additionally, we touch on androgyny and pedagogy: the subtle differences between adult learning principles and the learning style of children. Adults need to see utility in the learning while children can demonstrate attention span issues and often require the assistance of a caregiver. We will often indicate when a lecture format is warranted versus a demonstration, and make a distinction between things that one must know versus things that one must do, feel, or believe.

The final component we address with our students is evaluation of the learning session. The key questions are, "Did the patient receive all the information needed to care for him or herself?" and "Can he or she perform the procedures or techniques?" Central to this component of evaluation is the concept of return demonstration, which essentially entails having the patient show us how to perform the procedure before leaving the sessions. In short, emphasis is placed on the issues of control versus cure where the patient is informed that they will not necessarily be cured of their asthma but rather will learn how to effectively control it. One can see that we return to the theme of partnership and self-management.

Keir: Patient teaching is provided by the ED physician and the ED nurse prior to discharge. Asthma education is documented in the patient's chart. A checklist is provided including asthma education, asthma action plan, prescription of controller medications as appropriate, advice on smoking cessation, reminder for the annual influenza vaccination, and referral for follow-up to the primary provider. A fax summary of the ED care and recommendation is sent to the primary provider. Homecare visits are also provided if deemed necessary. This referral is done by the ED to our nurse coordinator, who then contacts the visiting nurses' agency.

A very important concept that our Asthma Initiative Committee was able to achieve is incorporating the chronic care model with the acute management of an asthma exacerbation – that is, the providers and professionals who are involved with the management of an acute exacerbation of asthma are the link in ensuring that the patient will be followed for long-term management

and asthma control. The providers and professionals are not just managing the acute exacerbation but are pivotal in prescribing the daily controller medications as appropriate, initiating asthma education, providing educational materials and resources, and referring them to appropriate follow-up care with the goal of significantly decreasing ED visits, an outcome measure of asthma control and a better educated patient and caregiver.

Morris: Respiratory therapists will educate the patient on inhalers and spacers and check technique if they receive a specific written order to do so. Otherwise no formal asthma education is initiated in the ED. This is also dependent on the provider and or any staff that may have a specific interest in asthma. If time allows, I initiate education including an asthma action plan, however in a busy ED it is not always possible. Patients are referred to their primary care provider, however, many uninsured patients use the ED as their primary provider so they just return to the ED when their inhaler is empty. This is a huge problem as it increases their risk of death from repeated AE, but also they are not given the education they need to try to manage their asthma.

References

1 Olajos-Clow J, Szpiro K, Julien B, Minard J, Lougheed MD. Emergency department adult asthma care pathway. Healthcare provider's perceived utility and barrier to implementation. Adv Emerg Nurs J. 2009;31(1):44-53.

2 Abramson, MJ, Bailey MJ, Couper FJ, et al. Are asthma medications and management related to deaths from asthma? Am J Respir Crit Care Med 2001;163:12-8.

3 Gibson, PG, Powell H. Written action plans for asthma: an evidence-based review of the key components. Thorax 2004;59:94-9.

Timothy B. Op't Holt, EdD, RRT, AE-C, FAARC, is Director of "Breath of Life" COPD and the Asthma Education and Therapy Program at Victory Health Partners Clinic in Mobile, Alabama. At the University of South Alabama, he is Professor, Department of Respiratory Care and Cardiopulmonary Sciences. He is the author or co-author of 8 books and 30 studies in journals as well as presented over 35 papers at international conferences.

William F. Galvin, MSEd, RRT, CPFT, AE-C is Program Director of the Respiratory Care Program, Gwynedd Mercy College, Gwynedd Valley, Penn.; a position he has held for more than 2 decades. He is also Chairman of the Advisory Board for Respiratory Care Program at Gwynedd. Mr. Galvin has been extremely active in respiratory medicine over the past 35 years; he is recognized as a leader in his field and respected for his excellent teaching abilities. In 2008, Mr. Galvin was presented with the the Lambda Beta National Honorary Life Membership Award, the most distinguished award presented by the society and presented annually to a single individual for outstanding contribution nationally to the art, science, literature or public understanding of the profession of respiratory care. Mr. Galvin lives near Philadelphia, Penn.

Catherine Kier, MD, FAAP, FCCP, is Associate Professor of Clinical Pediatrics, State University of New York at Stony Brook (NY). She is also Chief, Division of Pediatric Pulmonology, Allergy and Immunology, Stony Brook University Hospital SUNY at Stony Brook, NY, and Director of the Cystic Fibrosis Center and Pediatric Sleep Disorders Center at Stony Brook. Dr. Kier carries on many teaching and research duties at Stony Brook and is author or coauthor of many publications in respiratory and sleep medicine. She lives on Long Island, NY

Kathy J. Morris, DNP, ARNP is Assistant Professor, University of Nebraska Medical Center College of Nursing, and Director of the Family Health Care Clinic. She is also an emergency nurse practitioner at Premier Health Care Services, Alegent Health Council Bluffs, and at the Community Medical Center in Falls City, Nebraska. In 2009, Dr. Morris won the Distinguished Nurse of the Year Award for Nebraska (March of Dimes Award). She has presented on asthma at several national meetings and contributes to scholarly journals. She is currently president of the Association of Asthma Educators and is chair of the strategic planning committee.

Clinical Foundations is a serial education program distributed free of charge to health professionals. *Clinical Foundations* is published by Saxe Healthcare Communications and is sponsored by Teleflex Medical. The goal of *Clinical Foundations: A Patient-Focused Education Program for Respiratory Care Professionals* is to present clinically- and evidence-based practices to assist the clinician in making an informed decision on what is best for his/her patient. The opinions expressed in *Clinical Foundations* are those of the authors only. Neither Saxe Healthcare Communications nor Teleflex Medical make any warranty or representations about the accuracy or reliability of those opinions or their applicability to a particular clinical situation. Review of these materials is not a substitute for a practitioner's independent research and medical opinion. Saxe Healthcare Communications and Teleflex Medical disclaim any responsibility or liability for such material. They shall not be liable for any direct, special, indirect, incidental, or consequential damages of any kind arising from the use of this publication or the materials contained therein.

Please direct your correspondence to:

Saxe Healthcare Communications
P.O. Box 1282
Burlington, VT 05402
info@saxecommunications.com

Questions

1. **Factors associated with frequent exacerbations include:**
   a. recurrent respiratory and sinus infections
   b. gastroesophageal reflux
   c. medications
   d. all of the above

2. **Mr. L, a 75 year old Hispanic male, was seen in the asthma clinic for a new patient visit. After his history, physical examination and other appropriate testing, Mr. L.'s asthma severity was classified as moderate persistent asthma. What component was not included in the classifying moderate persistent asthma?**
   a. Nighttime symptoms 5 or more times a month
   b. Lung function test FEV1 above 60% but below 80% of normal values
   c. Symptoms of cough, wheeze, chest tightness, or difficulty breathing 3-6 times a week
   d. Symptoms of cough, wheeze, chest tightness, or difficulty breathing daily

3. **Signs of impending respiratory failure include all except:**
   a. an inability to speak and worsening fatigue
   b. altered mental status and a PaC02 of 42 mg or greater
   c. intercostal retraction and a PaC02 of 42 mg or less
   d. worsening fatigue

4. **According to Expert Panel Report 3, the risk of asthma examines all of the following except:**
   a. Side effects of medication
   b. Progressive loss of lung function
   c. Asthma exacerbation
   d. Daily use of short acting beta agonist

5. **Factors predicting severe deterioration warranting hospital admission include all of the except:**
   a. non-adherence with treatment
   b. acute severity with impaired lung function
   c. poorly controlled chronic asthma with co-morbidities
   d. psychosocial factors

6. **The Expert Panel recommends a short-acting β-agonist as initial treatment for all patients, oxygen for most patients, with additional multiple doses of ipratropium bromide for patients who have severe exacerbations in the emergency department.**
   a. True
   b. False

7. **A 21 year old Hispanic male with mild persistent asthma may be at risk for fatal asthma secondary to all except:**
   a. 3 or more emergency room visits and 2 hospital admissions within the past year.
   b. Low socioeconomic status or inner-city residence or illicit drug use
   c. A written asthma action plan and no difficulty perceiving symptoms
   d. Chronic lung disease and alternaria sensitivity

8. **The EPR-3 recommends consideration of heliox-driven, nebulized albuterol for patients who have life-threatening exacerbations and for patients whose execration remains in the severe category after one hour of conventional treatment.**
   a. True
   b. False

9. **According to Kier, what are the elements of asthma education in the ED?**
   I. reasons for daily treatment with ICS
   II. trigger identification
   III. the importance of allergy testing
   IV. delivery device training
   a. I, II, III only
   b. I, III, IV only
   c. I, II, IV only*
   d. II, III, IV only

10. **What is a conclusion health care providers share about the use of a standardized asthma pathway?**
    a. it improves awareness and adherence to best practice
    b. reimbursement is significantly increased
    c. readmission rate to the ED is halved
    d. patient satisfaction is improved

11. **In the care of the patient with asthma, the patient must assume a degree of responsibility and be an active participant in their care.**
    a. True
    b. False

12. **According to the NAEPP EPR-3, which of the following are steps to include in an algorithm for the care of a patient with an asthma exacerbation?**
    I. oxygen therapy
    II. administration of LABA
    III. patient assessment
    IV. administration of systemic corticosteroids
    a. I, II, III only
    b. I, III, IV only
    c. I, II, IV only
    d. II, III, IV only

This program has been approved for 2.0 contact hours of continuing education (CRCE) by the American Association for Respiratory Care (AARC). AARC is accredited as an approver of continuing education in respiratory care.

To receive continuing education credit, simply do the following:

1. Read the educational offering (both articles).
2. Complete the post-test for the educational offering online at www.saxetesting.com/cf. The questions are the same as above
3. Complete the learner evaluation.
4. To earn 2.0 contact hours of continuing education, you must achieve a score of 75% or more. If you do not pass the test, you may take it again one more time. You will not be charged to take the test a second time.
5. Upon completion, you may print out your certificate immediately. If you are an AARC member, your results are automatically forwarded to the AARC.
6. Accreditation expires Jan. 6, 2018 (RTs). Please consult www.clinicalfoundations.org for current annual renewal dates.

Please consult www.clinicalfoundations.org for current annual renewal dates.

Participant's Evaluation

1. What is the highest degree you have earned?
Circle one. 1. Diploma 2. Associate 3. Bachelor
4. Masters 5. Doctorate
2. Indicate to what degree the program met the objectives:

Objectives

Upon completion of the course, the reader was able to:

1. Discuss the major factors of an asthma exacerbation and signs of impeding respiratory failure.
   Strongly Agree 1 2 3 4 5 6 Strongly Disagree
2. Discuss management and prevention strategies of an asthma exacerbation.
   Strongly Agree 1 2 3 4 5 6 Strongly Disagree
3. Identify the roles of the health care providers in the treatment of asthma exacerbation in the emergency department.
   Strongly Agree 1 2 3 4 5 6 Strongly Disagree

Answers

1	☐☐☐☐	9	☐☐☐☐
2	☐☐☐☐	10	☐☐☐☐
3	☐☐☐☐	11	☐☐
4	☐☐☐☐	12	☐☐☐☐
5	☐☐☐☐	13	
6	☐☐	14	
7	☐☐☐☐	15	
8	☐☐	16	

All tests must be taken online at http://www.saxetesting.com/cf/