

Asthma: Approaches to Treatment and New Therapies

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Goal. The goal of this lesson is to provide an overview of asthma, including signs, symptoms, types and classification, review of guideline-based therapy, and discussion of recently approved therapies for asthma.

Objectives. At the completion of this activity, the participant will be able to:

1. demonstrate an understanding of the pathophysiology resulting in asthma symptomatology;
2. recognize the stages of asthma based on patient symptoms and the pharmacological treatment recommended at each stage;
3. identify new treatments that have recently been approved for asthma management;
4. describe adverse effects, safety concerns, and key counseling points associated with each inhaler used in asthma management; and
5. demonstrate an understanding of nonpharmacological interventions used to help manage asthma and the role of the pharmacist.

Background

Asthma is a chronic inflammatory disease that affects the airways of the lungs, resulting in shortness of breath or breathlessness, wheezing, chest tightness, and coughing, typically at night or early in the morning. Asthma symptoms

result from exposure to triggers that cause inflammation of the airways. These triggers vary from person to person. Common triggers include molds, air pollutants, cigarette smoke, exercise, burning wood, grass and animals. It is important for patients to know their triggers, to try to avoid those triggers as much as possible, and to know the signs and symptoms of an asthma attack when triggers cannot be avoided. Patients with known allergens (i.e., pollen) causing asthma symptoms should also try to minimize exposure to those. Households that have pets should keep the pets out of the bedroom of the child with asthma, and carpets should be minimized and/or vacuumed frequently. While there are therapies available to manage and minimize symptoms, there is no known prevention or cure.

Asthma is primarily a childhood disease that most patients eventually outgrow; however, adults can have asthma. This is the most common chronic disease in children. Prevalence is highest between ages 0 to 17. Adolescents (ages 12 to 19) are at the greatest risk for asthma-related morbidity due to under-reporting of symptoms and engaging in risk-taking behaviors. In 2011 alone, approximately 12 percent of high school students were diagnosed with asthma, making this population a key target for screening and proper management. Across all ages, approximately one in 12 Americans

have asthma, with 50 percent of those patients experiencing an asthma exacerbation each year, many of which could have been prevented with proper therapy.

There is a higher prevalence of asthma in African American children, with worse morbidity, greater likelihood of uncontrolled asthma, and more frequent emergency department visits. When looking at prevalence of asthma by ethnicity, African Americans have the highest prevalence at 9.9 percent, Caucasians are second at 7.6 percent, and Hispanic populations are lowest at 6.7 percent. Subsequently, African American patients are more likely to be hospitalized, require intensive care unit admission, and have poorer lung function as a result. These patients are also more likely to die as a result of their disease. Hispanic patients, excluding Puerto Ricans, are less likely than African American or Caucasian patients to be hospitalized for asthma. Before puberty, incidence is more common in male patients than female patients, and reverses to greater likelihood in female patients postpuberty. Incidence of asthma has grown over the last decade by 15 percent, making it a significant, costly, and very relevant public health problem.

Defining and Classifying Asthma Severity

A single test for diagnosis is not available for asthma. Collection of a good patient history is critical for

Table 1
Classification of asthma symptoms
(children ages 12 and older)

		Intermittent	Persistent		
			Mild	Moderate	Severe
Impairment	Symptoms	≤2 days/week	>2 days/week; not daily	Daily	Throughout the day
	Nighttime awakenings	≤2x/month	3-4x/month	>1x/week; not nightly	Often nightly
	SABA use (for symptom control)	≤2 days/week	<2 days/week; not daily	Daily	Several times/day
	Interference with normal physical activity	None	Minor limitation	Some limitation	Extremely limited
	Lung function	FEV ₁ >80% FEV ₁ /FVC normal	FEV ₁ >80% FEV ₁ /FVC normal	FEV ₁ 60 to 80% FEV ₁ /FVC reduced by ≤5%	FEV ₁ <60% FEV ₁ /FVC reduced by >5%
	Exacerbation History	Intermittent	Persistent		
Risk		0-2 each year	>2 in a year	>2 in a year	>2 in a year
	Recommended Initiation of Therapy	Step 1	Step 2	Step 3 (consider burst of oral corticosteroids)	Step 4 or Step 5 (consider burst of oral corticosteroids)

Modified from NAEPP guidelines

an accurate diagnosis. There are two key features of asthma resulting from the chronic inflammation of the airways, those being a history of respiratory symptoms and variable airflow limitation. Asthma has a strong genetic predisposition, making patients with parents with a history of asthma more likely to have asthma. Common symptoms include episodic dyspnea, wheezing, chest tightness and cough.

Spirometry should be performed. Evidence of variable expiratory airflow limitation with common symptoms of asthma are considered sufficient for a diagnosis of asthma, and treatment should be initiated. All patients who are over the age of five should have spirometry tests conducted, including FEV₁ (forced expiratory volume in one second) and a ratio of FEV₁/FVC (total forced vital

capacity). Upon administration of a short-acting beta agonist (SABA), airway obstruction should be at least partially reversed. At least once in the diagnostic process, a reduced FEV₁/FVC ratio should be noted. The normal ratio in adults is 0.75 to 0.80 and in children is 0.90. Frequently, a short-acting bronchodilator will be administered as part of the diagnostic process as well. An FEV₁ increase of greater than 12 percent of the predicted value is considered more variable than what would be seen in a healthy patient, confirming asthma diagnosis.

Asthma varies greatly in clinical presentation, varying from daily symptoms to only occasional, intermittent symptoms. Patients' classification of asthma severity will differ based on age. Table 1 provides the classification chart for

children ages 12 and older; these classifications will vary slightly for 0 to four and five to 11 years of age. Asthma severity will be determined by history of exacerbations, frequency of symptoms, frequency of nighttime awakenings, frequency of interference with normal activities, and lung function. The classification system provided is featured in *Guidelines for the Diagnosis and Management of Asthma (EPR-3)*, of the National Asthma Education and Prevention Program (NAEPP). These differ slightly from more recent guidelines produced by the Global Initiative for Asthma (GINA), which are updated yearly. While there are slight nuances between the two, overall classification is the same, and both integrate a similar stepwise therapy approach. Patients should be classified based on their most severe symptom. For

example, if a patient had three exacerbations in the past year (mild, moderate or severe persistent), had some limitations in physical activity (moderate persistent), and nighttime awakenings from symptoms (severe persistent), the patient should be classified as having severe persistent asthma.

Clinical Evaluation of the Asthma Patient

The 2016 GINA guidelines recommend confirmation of suspected asthma before initiating controller treatment as diagnosis is more difficult after the treatment has been started. Once the diagnosis is confirmed, it should be documented in the patient’s medical record. Patients should be assessed frequently, with key times of assessment being at times of medication refill, after an exacerbation, and when patients report more symptoms. A routine review should be conducted at least once a year. When first starting treatment, patients should ideally be seen within three months, and every three to 12 months after that. After an exacerbation, a follow-up should be scheduled within one week. The frequency at which patients are reviewed depends on the patient’s initial level of control, response to treatment, and engagement in self-management.

Asthma therapy should be stepped up when patients have remained symptomatic for two to three months despite use of maintenance medications. Prior to increasing therapy, adherence, correct inhaler technique, modifiable risk factors (i.e., smoking), and uncontrolled comorbid conditions (i.e., GERD, allergic rhinitis) should be assessed. If these factors are ruled out, therapy should be stepped up for at least two to three months. Short-term step-up of one to two weeks should be done when indicated by asthma action plan (i.e., symptoms due to allergen exposure).

Providers can consider stepping down therapy once the patient has achieved and sustained symptom

Table 2
Stepwise therapy initiation
(children 12 years of age and older)

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
SABA prn	Low-dose ICS	Medium-dose ICS	Medium-dose ICS AND LABA or montelukast	High-dose ICS AND LABA or montelukast	High-dose ICS AND LABA or montelukast AND oral corticosteroids

Modified from NAEPP guidelines

control for three months. Patients should be maintained on the lowest treatment that allows symptom control and prevents exacerbations to minimize side effects of therapy. When stepping down, the inhaled corticosteroid dose should be reduced by 25 to 50 percent every two to three months; however, these should not be completely withdrawn due to their benefit with minimal risk.

Treatment Algorithm for Asthma

Treatment of asthma will depend on whether the patient is experiencing an acute asthma attack or an exacerbation, and if the patient is being treated for prevention of these events. This lesson will focus on the treatment of chronic asthma. Asthma is treated with aerosolized therapies to deliver the drug to the site of disease activity, to enhance therapeutic activity, minimize side effects, and increase the therapeutic ratio of the medication. Due to increased efficacy and decreased side effects, bronchodilators and inhaled corticosteroids (ICS) have become the mainstay of asthma management. Therapies such as theophylline and leukotriene modifiers will not be discussed due to their decreasing use in practice. Of note, leukotriene modifiers are of greatest benefit in asthma management when also being utilized for allergy management.

The mainstay of asthma management is prevention of exacerbations and minimization of the underlying inflammation that causes the disease. Current management of asthma includes a

short-acting medication for acute symptoms, i.e., “rescue inhaler,” and long-term “controller” medications to prevent symptoms and exacerbations through reduction of inflammation. Table 2 provides the step-wise therapy approach that is utilized in *EPR-3*. GINA guidelines vary slightly, but capture the same general approach as *EPR-3*. All patients regardless of the long-term therapy selected need to have a quick-relief medication (short-acting beta agonist) available for acute symptoms. Inhaled corticosteroids are the preferred long-term therapy for asthma management due to their potency and cost effectiveness.

Drug Therapies for Asthma

Short-Acting Beta Agonists. Albuterol (e.g., ProAir® HFA) and levalbuterol (Xopenex®) are the two short-acting beta agonists (SABAs) that are available for asthma therapy. SABAs are a mainstay of asthma treatment, and all patients with asthma should have a SABA, both at intermittent and persistent stages of asthma. Albuterol is the most-commonly utilized SABA due to it being much more cost-effective than levalbuterol. Albuterol is a racemic mixture of both R- and S-enantiomers, whereas levalbuterol contains only the R- enantiomer. Levalbuterol has been marketed as having decreased potential for side effects than albuterol; however, in practice that has yet to be seen. In a small study that compared these two agents in management of an acute exacerbation, there were no noticeable differences in either efficacy (i.e., asthma scores, FEV₁

measure, etc.) nor frequency of side effects.

Inhaled Corticosteroids. Many inhaled corticosteroids (ICS) are available as monotherapy or as combination therapy with long-acting bronchodilators. ICS have been developed with both rapid oral and systemic clearance to enhance lung activity while also minimizing systemic activity. Due to low- to medium-dose ICS having very small risks whose benefit greatly outweighs any risk, ICS are preferred monotherapy for mild-to-moderate persistent asthma for all patients.

ICS provide benefit in asthma through their potent anti-inflammatory activity by reducing several mediators of inflammation. By doing so, lung function is improved while reducing the rate of exacerbations, and subsequently emergency department visits and hospitalizations. ICS do not reduce or prevent lung remodeling and/or loss of lung function, nor do they improve lung growth in children. However, they are the only therapy with evidence showing that they reduce the risk of dying from asthma, thus their prevalence in asthma management. When counseling patients about ICS therapy, proper inhaler technique is critical to minimize the systemic exposure to the medication. If patients have improper technique, they can swallow corticosteroid, leading to systemic exposure. All ICS inhalers require swishing and spitting after administration to reduce the risk of thrush from oral exposure to the corticosteroid.

ICS carry a precaution to alert consumers of a potential reduction in a child's growth, which can often limit initiation of ICS therapies when appropriate over concerns for this risk. Overall, the evidence points toward a small reduction in growth during childhood (1 cm), that is regained by adulthood; however, one study has shown a decrease in final adult height of 1.2 cm. It is important to keep in perspective that severe and uncontrolled asthma itself can lead to

decreased growth during childhood, and can delay the start of puberty by 1.3 years. As such, providers need to weigh the risk of potential loss in final height against the risk and impact of uncontrolled asthma. A child's asthma control should not be compromised due to concerns over height. Providers should aim to use the lowest dose of ICS possible that allows for adequate symptom control. There is no ICS that has demonstrated greater clinical efficacy. There are varying potencies, but increasing dosage can counterbalance that. Thus, ICS selection should be based on cost, type of inhaler deemed best for the patient, and availability with long-acting beta agonists (LABAs) if necessary.

Long-Acting Beta Agonists.

Three long-acting beta agonists are available and have indications for use in asthma, all as combination inhalers. See Table 3. Salmeterol and formoterol have more established histories in asthma management. Vilanterol is a newer LABA that is currently available as a combination inhaler with fluticasone (Breo Ellipta®). Breo Ellipta® is currently only approved for use in adults ages 18 and older. Another new LABA, indacaterol (Arcapta Neohaler™), has been introduced to the market. It is a 24-hour LABA, affording once-daily administration. Indacaterol is currently only approved for use in chronic obstructive pulmonary disease (COPD) due to safety concerns associated with LABAs and likely due to the fact that it is only available as monotherapy, thus complicating patient therapy. LABA therapy should not be used as monotherapy in asthma management; they should only be used in combination with ICS. LABAs are recommended for use in asthma at step 4 and step 5 as the preferred adjunctive therapy to ICS. LABAs are used to prevent bronchoconstriction that occurs in asthma, and, thus, work complementarily to ICS therapy.

The bronchodilating effects of both formoterol and salmeterol last over 12 hours; however, formoterol

provides a quicker onset of action. When comparing the efficacy of these two LABAs, evidence is mixed. Some studies have shown no difference in clinical benefit between the two, whereas some have shown benefit in salmeterol such as days without an attack being 1.71 days longer. When looking at lung function, there is no demonstrated difference in FEV₁ initially at 12 hours after inhalation. There is also a lack of difference in Borg score, a common scale to evaluate breathlessness. As such, there is likely minimal clinical difference between these two agents and selection should be based on appropriate ICS selection in ICS/LABA combination inhalers.

A Cochrane review compared the safety of salmeterol with fluticasone and formoterol with budesonide, beclomethasone, fluticasone, or mometasone. Only two deaths were found in the review; neither were contributed to asthma. Asthma-related serious side effects were found to be rare, with no difference between agents. All LABAs carry black box warnings regarding increased risk of asthma-related death, and risk may be greater in African American populations. In a placebo-controlled trial, salmeterol or placebo were added to typical asthma therapy in patients who were not well-controlled. Out of just over 13,000 patients, there were 13 deaths with salmeterol and three with placebo. It is not known if current use of ICS mitigates this increased risk. As such, LABAs should not be used as monotherapy in asthma management, and are contraindicated. In patients who are not controlled on low- or medium-dose ICS, salmeterol and formoterol can be used in combination. Patients should be assessed at regular intervals once symptom control is achieved and maintained; and should be stepped down as appropriate.

Long-Acting Anti-Muscarinics.

Traditionally, long-acting anti-muscarinics (LAMAs) have been reserved for use in COPD. Tiotropium bromide (Spiriva Respimat®)

was also recently approved for use in asthma management. It is the first new drug class to be approved for use in asthma in over a decade. Only the Spiriva Respimat[®] device, an inhaler that produces a soft mist for inhalation, is indicated for use in asthma. The Spiriva Handihaler[®] device is not approved in asthma, only in COPD. The Spiriva Respimat[®] device is easier for patient administration as it does not require a deep, forceful breath like the Handihaler[®] (dry powder inhaler [DPI]), nor does it require the coordination necessary for metered dose inhalers (MDIs). According to the package insert, Spiriva Respimat[®] is approved as add-on therapy in asthma for adults and children 12 years of age and older. However, the recommendations for use of tiotropium in asthma management varies within the GINA guidelines. GINA guidelines recommend use in adults 18 years and older, and recommend tiotropium as add-on therapy when patients have a persistent history of exacerbations or when patients are utilizing high-dose ICS with LABA and symptoms persist or the patient experiences side effects.

When acting on smooth muscle in the bronchioles of the lungs, tiotropium causes bronchodilation and is believed to inhibit release of pro-inflammatory substances, decreasing airway inflammation. Tiotropium may also decrease mucus in the airways. Despite the same mechanism of action with a more rapid response, short-acting anti-muscarinic (SAMA) therapies have not become part of asthma guidelines, nor do they currently have an indication for use in asthma. As such, only LAMA therapies should be recommended for use in asthma. Combivent[®] Respimat[®] (albuterol and ipratropium) does have an off-label indication for use in asthma, which could be considered as it contains both a SABA (albuterol) and SAMA (ipratropium).

A systematic review evaluated both the clinical efficacy and the safety of tiotropium compared to standard-of-care medications

(ICS alone or ICS-LABA combination). When added to an ICS or ICS-LABA regimen, tiotropium improved lung function; however, it also maintains lung function when ICS are tapered and LABAs are discontinued if either need to be discontinued due to safety concerns or side effects. No safety concerns were identified in these studies. Another systematic review showed improvement in FEV₁ from baseline in symptomatic asthma patients while maintained on other controller medications (i.e., ICS and LABA) as well. A single clinical trial evaluated the benefit of tiotropium bromide in patients with hard to manage asthma, and was found to be a viable add-on option to help maintain bronchodilation for 24 hours. FEV₁ was significantly improved in patients using tiotropium compared to placebo. The time to exacerbation was improved in patients concurrently using tiotropium bromide and ICS therapy; reduced hospitalizations rates were also found. Therefore, this medication provides a valuable option in patients with moderate to severe persistent asthma despite use of an ICS or ICS-LABA.

Immunizations. The chronic nature of asthma increases the risk of pulmonary infections in patients. These infections are considered a significant risk for mortality in all chronic diseases; therefore patients with asthma require special preventative care. Adults and children two years of age and older should receive the pneumococcal polysaccharide vaccine 23-valent (PPSV23) due to susceptibility to pneumococcal infection. The vaccine should be given as soon as possible after diagnosis. Annual influenza vaccination is also recommended by the Advisory Committee for Immunization Practices (ACIP) for patients with asthma. Early October is the best time to vaccinate to ensure protection at the onset of flu season, as well as throughout the season. Patients should receive either quadrivalent inactivated influenza vaccine (IIV4) or trivalent inactivated influenza vaccine (IIV3)

(injection) versus quadrivalent live, attenuated influenza vaccine (LAIV) (intranasal FluMist) over concerns for immunosuppression. Further, in 2016, ACIP recommended against use of the inhaled quadrivalent formulation due to poor efficacy.

Emerging Therapies. Anti-IgE therapy is available for patients with severe asthma and frequent exacerbations that persist despite maximized controller medications. Omalizumab (Xolair[®]) is a humanized monoclonal IgG₁ antibody that reduces free serum IgE levels, minimizing the allergic component of asthma. This medication has not been extensively studied in children <12 years of age and should be carefully evaluated in that population. Anaphylaxis has been reported with omalizumab in children; administration in the hospital is recommended. Patients must be provided with epinephrine if prescribed. Otherwise, the medication is fairly well tolerated, although expensive. Omalizumab has shown decreased steroid dosage, improved daily symptoms, improved quality of life, reduced exacerbation frequency, and reduced SABA use. This medication is recommended in step 5 and step 6 asthma for patients who also have allergies. Macrolide antibiotics also have an emerging role in asthma management. They offer dual benefit with reduction in airway inflammation and antibacterial effects. Evidence within pediatric patients is very limited, but initial studies have shown decreased production of inflammatory substances and improved symptom duration during exacerbations. While macrolides should not be recommended at this point in asthma management, since they are well-tolerated there is merit in evaluating their clinical value in managing difficult to control patients.

Counseling on Inhaler Use and Technique

Selecting an inhaler device that patients are able to correctly administer is just as critical as

Table 3
Selected inhalers approved for use in asthma

Brand Name	Generic Name	Type of Inhaler
<i>Inhaled Corticosteroid Inhalers (ICS)</i>		
Asmanex® Twisthaler®	Mometasone Furoate	Dry Powder Inhaler
Asmanex® HFA	Mometasone Furoate	Metered Dose Inhaler
Pulmicort® Flexhaler®	Budesonide	Dry Powder Inhaler
QVAR®	Beclomethasone Propionate	Metered Dose Inhaler
<i>Combination Inhaled Corticosteroid Inhalers (ICS) and Long-Acting Beta Agonists (LABA)</i>		
Advair® Diskus®	Fluticasone Propionate and Salmeterol	Dry Powder Inhaler
Advair® HFA	Fluticasone Propionate and Salmeterol	Metered Dose Inhaler
Breo® Ellipta®	Fluticasone Furoate and Vilanterol	Dry Powder Inhaler
Dulera®	Mometasone and Formoterol	Metered Dose Inhaler
Symbicort®	Budesonide and Formoterol	Metered Dose Inhaler
<i>Long-Acting Anti-Muscarinic Inhalers (LAMA)</i>		
Spiriva® Respimat®	Tiotropium bromide	Soft Mist Inhaler
<i>Monotherapy Long-Acting Beta Agonists are not listed above due to their black box warning; and combination ICS/LABA inhalers decrease medication burden. The most commonly prescribed inhalers are listed above.</i>		

selecting the appropriate medication based on symptom severity. There have been significant improvements in the design and types of inhalers over the past 35 years; however, this has not correlated with improved patient ability to use the inhaler correctly. Patients' adherence to their inhaler is likely impacted by the attitudes toward and experiences in using the inhaler device. If the patient feels the therapy is not working, subsequent adherence is likely to be poor with reduced efficacy of treatment. When used correctly, there is a no difference in clinical efficacy between the various inhaler types. Both patients and the very health-care practitioners who educate them about inhaler use have not been able to correctly demonstrate proper inhaler administration technique. Synchronization (the correct inhalation flow following actuation) is the main step in the administration process where patients fail and extra attention should be paid to

correcting this.

Inappropriate inhaler use has been shown to result in poor symptom control, increased cost, and increased drug exposure to less well-tolerated therapies. Providers should work extensively when designing a treatment regimen to assess if the patient has any preferences in inhaler type, and should try to have the patient demonstrate inhaler technique with a placebo device. Therapies that patients are most proficient in should be selected. Literature has shown greater success with breath-actuated dry powder inhalers or pressurized MDIs with spacers, than MDIs alone. When significant errors in administration were noted, there were greater risks of poor asthma control and more systemic corticosteroid bursts for exacerbations. As such, providers should ensure MDIs are used with a spacer as much as possible. Dry powder inhalers should be used if the patient struggles with use of the spacer

and can mobilize the dry powder from the inhaler correctly.

Efforts should be made to minimize transitioning between varying types of inhalers, unless the patient is not satisfied or cannot correctly administer a type of inhaler. The availability of several types of inhalers can confuse patients, and with differences in administration technique, consequences may result. Literature has shown that patients are resistant to changing inhalers over concerns about being trained on their current device and not understanding the need for a change. Lack of understanding for administration can lead to unintentional adherence issues, and providers should provide extensive training and reasoning for inhaler changes in an attempt to diminish risks for non-adherence. There is conflicting evidence in the literature when evaluating the impact that different inhaler devices have on patient disease control through their therapeutic effects. As such, pharmacists should recommend and encourage use of inhalers that the patient is comfortable with, competent in the use of, and that provide necessary therapeutic agents for the stage of asthma the patient is experiencing.

Appropriate patient counseling and re-education is necessary to ensure correct inhalation technique for all inhalers. Reporting of patient education on inhalers is very low. Nearly 25 percent of patients receive no verbal instruction on their inhalers, and nearly 50 percent only receive one session of 10 minutes or less. Literature varies in reports showing rate of incorrect inhaler technique, but it has been as high as 94 percent. Poor inhaler technique puts patients at risk for poor disease control, worsening symptoms, and potential exacerbations and hospital admission. Pharmacists should ensure all patients are properly educated with the first inhaler dispensed, and should re-educate when refilled.

Pressurized Metered Dose Inhalers. These inhalers require significant coordination skills and

should be avoided in patients with major barriers to coordination that cannot be fixed with spacer use. Ideally, all patients should use a spacer with MDIs; it is critical for children and the elderly to use these with a spacer. A retrospective analysis found that 64 percent of patients were on MDIs alone for their asthma control and 14 percent were using an MDI with a spacer. Given the significant challenges associated with these inhalers, increased use of spacers is advised. Further, previous literature has demonstrated that more than 60 percent of patients were unable to use their MDI correctly after being educated on proper use on three separate occasions.

Dry Powder Inhalers. These inhalers require a turbulent flow of air to transform the metered powder (formulated with a lactose carrier) into smaller particles that can be absorbed in the lung. This lung flow must be maintained from the start of inhalation for an extended amount of time. Patients must breathe as deeply and forcefully as possible to move the powder, which can be a challenge given the variable airflow limitation asthma itself causes. Airflow limitations inherent with the disease may affect distribution of the active ingredient. The benefit of DPIs is that they do not require coordination. These inhalers are also challenging from a patient use standpoint as successful delivery with these devices is very technique dependent, and the technique varies greatly between available DPIs such as the Diskus[®], Respiclick[®], HandiHaler[®], Turbohaler[®], and many others.

Lifestyle Considerations

As a result of asthma pathophysiology, patients living with asthma experience limited exercise capacity. It is challenging for patients to distinguish breathlessness due to bronchoconstriction and breathlessness due to exercise-induced hyperventilation. As a result, patients may lead a sedentary lifestyle absent of exercise due to anxiety surrounding this. Exercise train-

ing for patients with asthma, both adults and children, has shown positive impact on physical fitness when sustained (>6 months). Patients living with asthma should be encouraged to develop an exercise regimen to help manage symptoms and improve exercise capacity, under proper medical supervision.

The role of triggers in asthma symptoms has been previously discussed. Pharmacists and other healthcare providers should work with patients to help identify their triggers. Previous literature has identified that asthma trigger management is suboptimal in clinical practice, leading to more symptomatic patients with uncontrolled asthma. Educational interventions to increase adolescents' self-efficacy in modifying triggers has been shown to be effective and should be a key component of initial education upon diagnosis and should be frequently revisited to optimize patient care.

Written asthma action plans are standard care, but are poorly implemented and utilized in real life. Mobile phone applications are growing in popularity and prevalence in asthma care. Studies have demonstrated that they are effective in assessing asthma symptoms and medication adherence in adolescent patients. An application was developed to provide patient access to his/her asthma action plan. This application integrated all traditional components into an application where patients could easily enter pertinent symptoms and condition details, resulting in a projection of where the patient falls in his/her action plan. This application was well-received by patients and caregivers, in both functionality and convenience. Given challenges that are prevalent in adolescent populations and incidence and prevalence of the condition in that patient population, hopefully tools like this will allow meaningful patient self-management of asthma and improved frequency of asthma control.

Preventing Asthma Exacerbations

Despite existing treatment guidelines and advances in asthma therapies, acute asthma exacerbations still continue to be prevalent. These present considerable burden on caregivers, patients, providers, and the healthcare system. Timely patient education and follow-up after asthma exacerbations is crucial for improved patient symptom management and prevention of subsequent exacerbations. Controlling persistent asthma and prevention management in intermittent asthma are also key.

Once a patient or caregiver is aware of the triggers for a patient's asthma, efforts should be made to minimize exposure or avoid these triggers as much as possible. Reducing use of carpet in the home and limiting pets in sleeping areas, as well as frequent vacuuming, can be helpful. Tracking patients' adherence and proper inhaler technique is critical. Pharmacists should convey that with therapies currently available, patients should be able to live a relatively symptom-free life. If patients continue to be symptomatic, pharmacists should investigate adherence, cost, or administration issues, and work to identify solutions with patients.

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This lesson is a knowledge-based CPE activity and is targeted to pharmacists in all practice settings. **Disclosure.** The OPF trustees and other individuals responsible for planning OPF continuing pharmacy education activities have no relevant financial relationships to disclose.

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1. Tiotropium bromide is approved for use in adult asthma patients:
 - a. >18 years of age.
 - b. and children ≥ 12 years.
 - c. and children ≥ 5 years.
2. Which of the following medication classes carries a black box warning for increased risk of asthma-related deaths?
 - a. SABA
 - b. LAMA
 - c. ICS
 - d. LABA
3. What type of inhaler requires significant coordination for proper administration?
 - a. Soft Mist
 - b. Dry Powder
 - c. Metered Dose
4. Asthma is most prevalent in which patient population?
 - a. Caucasian
 - b. Hispanic
 - c. Asian
 - d. African American
5. The recommended stepwise initiation therapy for a patient diagnosed and classified with moderate persistent asthma is:
 - a. SABA prn only.
 - b. SABA prn and low-dose ICS.
 - c. SABA prn and medium-dose ICS.
 - d. SABA prn, LABA and high-dose ICS.

6. Which pneumococcal vaccine should be given to a 22-year-old with asthma?
 - a. PPSV-23
 - b. PCV-13

.....
Completely fill in the lettered box corresponding to your answer.

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|--------------------|--------------------|---------------------|
| 1. [a] [b] [c] | 6. [a] [b] | 11. [a] [b] [c] [d] |
| 2. [a] [b] [c] [d] | 7. [a] [b] [c] [d] | 12. [a] [b] [c] [d] |
| 3. [a] [b] [c] | 8. [a] [b] [c] [d] | 13. [a] [b] |
| 4. [a] [b] [c] [d] | 9. [a] [b] [c] | 14. [a] [b] [c] [d] |
| 5. [a] [b] [c] [d] | 10. [a] [b] | 15. [a] [b] [c] |

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 yes no If no, why? _____
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2674 Federated Blvd, Columbus, OH 43235-4990**

7. Which influenza vaccine should be given to a 22-year-old with asthma?
 - a. Egg-free
 - b. High-dose
 - c. Live, attenuated
 - d. Inactivated
8. LAMAs may be recommended in which type of asthma patient?
 - a. Newly diagnosed, treatment naïve
 - b. 8-year-old with step 4 asthma
 - c. 23-year-old with step 5 asthma
 - d. 16-year-old with step 2 asthma
9. Omalizumab can be considered in patients with which comorbidity?
 - a. Nicotine dependence
 - b. COPD
 - c. Allergies
10. Written asthma action plans are standard care for asthma patients.
 - a. True
 - b. False
11. Health providers should consider stepping down asthma therapy when patients have been symptom-free for:
 - a. 1 month.
 - b. 3 months.
 - c. 6 months.
 - d. 12 months.
12. Use of which of the following medications would require the patient to rinse out his/her mouth after use?
 - a. Tiotropium
 - b. Albuterol
 - c. Mometasone/Formoterol
 - d. Albuterol/Ipratropium
13. Indacaterol is recommended in asthma management.
 - a. True
 - b. False
14. What type of inhaler does not require a deep, forceful breath to transfer medication into the lungs?
 - a. Respimat®
 - b. Handihaler®
 - c. Resplick®
 - d. Turbohaler®
15. Spacers should be used with which type of inhaler to improve drug delivery?
 - a. Metered Dose
 - b. Soft Mist
 - c. Dry Powder

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