

Asthma Education — Home-based Intervention

Thomas J. Kallstrom

Respiratory Care Services and Biometrics, Fairview Hospital, Cleveland, Ohio, U.S.A.

In order for patients with asthma to maintain an adequate level of self-management of the disease they must be provided initial and ongoing education. Education is a major tool in order to achieve this goal. This review discusses some of the components of asthma education that must be considered. There are also opportunities for the respiratory therapist to play a significant role in asthma disease management in the home. Education is a key tool in the management of asthma. The respiratory care professional can play a significant role in a home-based program.

Key Words

asthma;
education;
home and respiratory therapist;
self-management

Asthma education as an essential tool in management of asthma

One of the most effective and long lasting interventions in the management of asthma is education. Patients, families, and caregivers must be able to care for themselves or family members once away from the clinical setting. Without a strong basic understanding of the disease and solid self management skills chances are favorable for increased emergency department visits or admission to the acute care facility. Patient focused education will allow the patient to gain motivation, skill and the confidence that they can use to control their asthma.¹ It is also likely that education that is directed at self-management can reduce morbidity,² improve lung function, feelings of self control, reduce absenteeism from school, number of days with restricted activity, number of visits to the emergency department, and possibly the number of sleep disturbed nights.³ It is through the learning of management and coping skills that the asthmatic patient will be better able to attain control of their asthma and a higher level of quality of life.

In the West, the effectiveness of patient education on improving self-management has been well documented. However, the data among Asian population are lacking. A study by Choy *et al.*⁴ found that a hospital based

asthma education program could be effective especially among Asian populations of low socioeconomic status and education level. Patients in this study were instructed on pathophysiology of asthma, triggers, use of medications, proper inhaler technique, and self-management of the disease of asthma. As a result of this intervention patients demonstrated significant improvements in inhaler technique, asthma knowledge, reductions of hospitalizations, visits to family physicians, and emergency department utilization. Of particular interest is that patients with FEV1 of < 80% predicted values were more likely to benefit from the program. Chen *et al.* reached a similar conclusion⁵ that most asthmatic children do not use inhaler devices appropriately and that more aggressive education in Taiwan is necessary. More research in this portion of asthma management in Asia is needed. It is likely that the same positive results found in other parts of the world are just as likely to be realized in Asia.

Asthma education is such an essential part in the care and management of asthmatic patients that it is listed as the 1 of the 4 essential components of the National Institutes of Health (NIH), National Asthma Education and Prevention Program's (NAEPP) Expert Panel Report 2: Guidelines for the Diagnosis and Management of

Received: March 10, 2003.

Accepted: March 9, 2004.

Correspondence to: Thomas Kallstrom, Fairview Hospital Respiratory Care Services, 18101 Lorain Road, Cleveland, Ohio 44111, U.S.A.

E-mail: tom.kallstrom@fairviewhospital.org

Asthma.⁶ In addition to this education is also a component of the GINA Asthma Guidelines issued in 2002.⁷ Not only can asthma education increase the knowledge of the disease of the patient and family but it will also decrease parental anxiety.⁸ It is therefore suggested that clinicians determine the level of anxiety when taking a patient history, and should also support and encourage the patient's participation in asthma education programs.⁹ Parental perceptions regarding the use of medications and management of the disease can likely positively impact the care that is provided to patients between the ages of 2 to 18 years of age. It is therefore highly recommended that parental and child asthma education be provided and structured into a asthma wellness or "tune-up" visit.¹⁰ Education that is presented in the form of a home-based intervention may aid in the reduction of parental concerns and increase the use of coping strategies that are followed. While asthma education is an essential element of ongoing management of the disease, some settings are more appropriate than others. A home based approach and acute care facility education and intervention can be successful.¹¹

Opportunities for asthma education in different environments

Home-based programs may serve to bridge the gap between best practice and putting practice into action. Such programs in a population based program can improve functional status, increase self-monitoring, and knowledge about asthma, and decrease absenteeism and hospitalization for asthma by directly providing asthma patients with educational materials and self-monitoring tools.¹² Home-based programs will be described in more detail later in this review.

Formal education has been followed as the primary way to get the asthma message across. Other options are face-to-face, group education, or home based video education. All 3 methods are effective in increasing patient and parental knowledge. However, if one of the goals of asthma education is to reduce parental anxiety, a more effective method is to present the education in an interactive, face-to-face setting.¹³ In contrast to this is limited education, which is provided in the form of information only to adults with asthma. In this scenario the outcomes may be less favorable and may not im-

prove any health outcomes in this population. It is possible that dissemination of information only in the emergency department may be effective but more study needs to be done to confirm this.¹⁴ The emergency department however may not be the optimal setting for the education to occur.¹⁵ In the United States there are few emergency departments that actually use any type of formal asthma education. Part of the reason for this is that effective teaching in this environment may be hampered due to the critical health needs of the patient, poor staffing, limited resources, and a heightened level of acuity and anxiety. In addition, patients who use emergency department may find there is poor access to adequate follow-up.¹⁶ Once out of the emergency department, it is up to the patient to follow up with a physician. Unfortunately, this is often not the case.

Asthma education can result in a lower cost of care.¹⁷ In 1999 a study by Behbehani *et al.* found that the median direct medical care for the management of asthma in Canada associated in the emergency department was \$324,000 and for each hospital day was \$324,000/day.¹⁸ With the costs of managing the disease on the rise, cost containment becomes even more essential as a management tool for the disease. Asthma education that addresses overall understanding of the disease process, trigger avoidance, and self-monitoring can significantly impact the overall cost of care.¹⁹ In addition to the cost of care asthma has a significant impact on quality of life and lost wages.²⁰ When an asthma education program is part of an inner-city intervention a cost savings may be realized as well.²¹

An appreciation of cultural and ethnic diversity is essential

It is also essential that the educator is sensitive the ethnic and cultural background of the patients and family members that they are teaching. It is also important that the clinician is acutely aware of the patients' perception and knowledge of asthma. In an effort to get the message across to patients of other nationalities it is important that the clinician understand that each cultural and ethnic background has specific values, beliefs, and practices that are unique to each group. Therefore there must be some level of cultural sensitivity. Key to this is an appreciation for:

- Age
- Sex
- Gender
- Education
- Socioeconomic background

Compliance or adherence to care is an issue that is affected the education that patients receive. Low compliance is associated with young age, smoking, moderate asthma, being a newly diagnosed asthmatic, being employed, and being treated only by a generalist. Improvement in the care of asthma requires a high level of commitment of the patient and those associated with the patient (physicians, patients, health plans, and employers).²²

It is important that the clinician assess cultural or ethnic beliefs or practices that may influence self-management and then to modify them as appropriate.²³ An effort should be made to communicate with the patient in their native language so that all educational messages are fully understood. A lack of language concordance between a clinician and patient affects adherence and appropriate and the appropriate use of health care services.²⁴ In addition to this an understanding of what is beneficial and harmful must be achieved and then passed on the patient. An appreciation of cultural practice in the management of disease is important for the caregiver to possess. Harmful home remedies should be identified and the patient informed of the need to curtail practices that could compromise any control of asthma or even could put the patient's life at risk.

Asthma in America

Of concern is the general lack of knowledge of the care and management of the disease by not only the general public but of many asthmatics in the United States.

According to the Asthma in America Survey completed in the late 1990 this concern was confirmed. This survey was given to 2,509 asthma patients, 512 physicians, and 1,000 members of the general public. It uncovered 5 disturbing conclusions regarding the state of asthma in America. They include:

- Asthma control falls short of the goals established by the National Institutes of Health.
- Poorly controlled asthma results in hospitalizations, emergency room visits, missed days from

work and school, and activity limitations that often result in a lower quality of life.

- Physicians report that they are following the NIH guidelines but the level of care reported by patients does not meet the current standards.
- There is a significant misunderstanding by patients regarding the underlying cause of asthma symptoms. This also includes the ability of the patient to know which medication to take for management of the disease.
- There is a significant gap between what physicians claim is being taught, and provided to manage the disease and what the patient perceives.

The need for more and better patient directed information was noted in this survey. When patients were asked what the underlying condition that causes asthma symptoms were, only 9% of the patients could state that this cause was due to inflammation. This is compared to 10% of non-patients in the general population. This is of particular concern as there was no difference between the answers posted by the general public and patients already diagnosed with the disease. One would have thought that the asthmatic population had a higher knowledge of the disease; this just was not the case.

When the same asthmatic patients were asked to describe which medications are more appropriate for the management of the inflammatory process; 47% stated short-acting beta agonists compared to 35% who thought that anti-inflammatory medications were the drug of choice. This landmark survey indicated that there was widespread misunderstanding about asthma and the management of the disease at the level of the patient. Not surprisingly, 71% of patients with the diagnosis of asthma expressed a strong desire for better and more asthma education.

In addition, the same study found that although physicians report that they are following the guidelines, there is a major disconnect between what they claim to have taught and provided and that which the patient perceives (Fig. 1). In all categories the patients and physicians significantly disagreed except for demonstration of the inhaler device. This indicates that communication and adherence to the National Asthma Education and Prevention Program (NAEPP) Expert Panel Report II: Guidelines for the Diagnosis and Management of

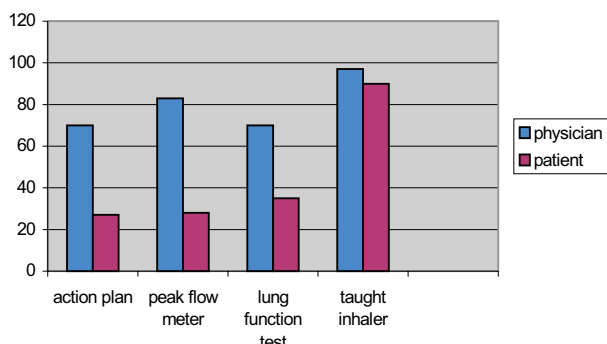


Fig. 1. Asthma in America Survey: A Gap in Patient-Provider Communications.

Asthma²⁵ are not being followed as had been the expectation of the National Institutes of Health (NIH) when the Guidelines were published.

It is entirely possible that a large population of patients in the United States who have been diagnosed with asthma may not have a full understanding of the disease and the treatments necessary to manage it. Another survey of asthma patients and health-care providers disclosed that a large number of asthma patients underestimate the severity of their condition and also may overestimate how well their asthma is being controlled.²⁶ As a result one suggested method of intervention is better communication and patient directed education in an effort to address the patient's cultural and lifestyle practices, including environmental exposures. To accomplish this suggested approaches to follow are:

- ✓ Develop long term proactive partnerships with physicians
- ✓ Establish a collaborative approach to care
- ✓ Encourage adherence to treatment plans
- ✓ Encourage more and better communication with patient
- ✓ Ask patients open ended questions
- ✓ Probe for underlying fears/concerns
 - ✓ Patient/provider communication problems
 - ✓ Lack of faith in medications

The NAEPP's Expert Panel Report II: Guidelines for the Diagnosis and Management of Asthma strongly supports the notion of education. According to the guidelines education is an essential component of successful asthma management. It is strongly felt that education must begin at the time of diagnosis and continue on at

each interaction between the healthcare clinician and the patient. By continuing on with an education-based theme the patient can continually be provided with expert direction in the management of their disease. Educational efforts should be continuous. It is also important that the clinician periodically review the information and skills that were previously learned in an effort to determine if there has been a positive impact on the patient. This is also important because without doing so the patient's skills in self-management may decline over time.²⁷

Teaching the essentials of self management

The Expert Panel Report II: Guidelines for the Diagnosis and Management of Asthma recommends that clinicians teach patients and families the essential information, which includes; medication skills, self-monitoring techniques, and environmental control measures.

When teaching patients and families the basic facts about asthma it is important not to overwhelm the listener. Provide a brief explanation of what asthma is. Included in this should be what the underlying causes of asthma are, what actually happens to the body when an asthma episode occurs and what steps can and should be taken to better manage the disease. It is important that the patient not become overwhelmed with too much at 1 time. Instead a better approach would be to repeat the essential messages at each visit. When reviewing medications and delivery of such it is useful to have the patient demonstrate their administration technique. Then in a non-threatening manner the clinician can assess and critique the patient. Essential medication skills that are important to master are the correct use of the inhaler, use of the spacer or holding chamber, and knowing when it is necessary to self-administer the medications.

To know when to self-administer it is necessary to be able to possess self-monitoring skills. These skills include the ability to determine when there are early signs of respiratory compromise. A peak flow meter and an action plan are 2 relatively inexpensive tools that the patient and family can use to maintain ongoing monitoring of the progression of the disease. These 2 self-management approaches can also allow the patient to develop a sense of ownership and responsibility of the management of asthma. It does require the cooperation of the physician and the clinician to obtain these critical

self-management tools.

Establish a partnership with the patient and caregivers

Another fundamental component of self-management is the development of a partnership between the patient and clinicians. It is important that there be a short and long term treatment goal. This goal once understood and achieved will serve to enhance this important partnership and ultimately improve the management of the disease.²⁸ At the time of the initial visit it is important to agree on short-term goals. Variables like the patient's inability to be involved with physical activity or an inability to maintain school attendance at a level comparable to the non-asthmatic students are important to note. As goals are developed it is important to do so in a joint fashion. The patient must agree with the clinician that the goals are attainable. It is then important for the clinician and family members to promote a high level of encouragement and positive reinforcement to the patient as they attempt to achieve their goals.

In addition at each patient clinician interaction there should be a review of the self-management plan and adjustments made as indicated. This may become necessary as the patient achieves some of the goals or cannot achieve them for various reasons. Sometimes it is because of a medication that is not resolving a problem or perhaps a poor method of delivery that is causing the patient some problems. In some instances it may be as simple as the need to change a medication because the taste of it is found to be disagreeable to the patient and as a result is affecting their compliance.

The clinician/patient partnership is also enhanced with periodic review of the asthma action plan. Over time it may need to be altered as the patient's age, growth and health status changes. Key to this partnership is a continual educational reinforcement. Patients in this phase of care should continue to receive brief written materials that can serve to reinforce that which has already be recommended or skills that have been taught.

Obviously in order to maintain a high level of care communication with the patient is very important. In order to get the feedback necessary from the patient it is preferable to pose open-ended questions as opposed to questions that only require a yes or a no response (Table 1).

It is therefore essential that there be an open communication between the patient, clinician, physician, and caregivers. It is important that there is a discussion with the patient and their family of any concerns that they may have about their asthma and then to address those concerns at that time. Communication and patient trust is key in the educational process. A partnership between the clinician and patient must be established and maintained over time.

Home care

It is essential that any education that is directed at patients, family and caregivers is modeled to the needs of that particular patient. It is unwise to assume that all patients need the same amount or level of education. Education to be successful needs to be tailored to the need of each individual patient. Education is more likely to realize a successful outcome if done in an environment that is non-threatening to the patient. The best place to do so is in the patient's home. This is appealing because once away from the many distractions of the hospital, clinic or even the physicians office, a patient is more likely better able to relax, listen, and learn.

Home-based programs

Home based asthma education and intervention programs come in many forms. Some in the United States are comprised of nothing more than providing the patient with written material, videotapes, CD ROMS, and an occasional telephone follow-up. I was fortunate enough to co-design a home-based asthma education and intervention program in the mid 1990's. This program was based in a home medical equipment company in Cleveland, Ohio.²⁹ In this program patients from a large academic hospital were enrolled when it was determined that the patient was in need of additional intervention. This was noted when these patients were admitted to the hospital, had frequent visits to the emergency department, were admitted to the intensive care unit, or the physician or case manager felt it was necessary.

Once enrolled into this program a respiratory therapist would visit the patient in their home up to 4 or 5 times. Each visit took at least an hour. The initial visit included an environmental assessment, asthma knowledge examination, medication and therapy assessment, and a

Table 1. Sample Follow-up Questions⁶**Signs and Symptoms**

In the last 2 weeks how many days have you?

- Had problems with coughing, wheezing, shortness of breath, or chest tightness?
- Awakened at night from sleep due to coughing or other asthma symptoms?
- Awakened in the morning with asthma symptoms that did not improve within 15 minutes of inhaling a short-acting bronchodilator?
- Had symptoms while exercising or playing?

Monitoring Lung Function

- What is the highest and lowest your peak flow has been since your last visit?
- Has your peak flow dropped below your personal best since your last visit?
- What did you do when this occurred?

Monitoring Quality of Life/Functional Status

Since your last visit, how many days has your asthma caused you to:

- Miss school or work?
- Reduce your activities?
- (For caregivers) Change your activity because of your child's asthma?

Monitoring Pharmacology

Medications:

- What medications are you currently taking?
- How often do you take the medications?
- How much do you take?
- Have you missed or stopped taking any regular doses of your medications for any reason?
- How many puffs of your quick-relief medication do you use per day?
- Have you had any side effects from the medications and if so what are they?

Monitoring Patient-Provider Communication and Patient Satisfaction

- What questions do you have about your asthma daily self-management plan?
- What problems have you had following your self-management plan?
- Has anything prevented you from getting the treatment you need for your asthma?
- Have the costs of the medications interfered with your ability to get asthma care?
- How satisfied are you with the asthma care that you are now receiving?
- How can we improve your asthma care?

Table 2. Common Allergens

- All warm-blooded pets, including small rodents and birds (dander, urine, feces, and saliva from these animals can cause allergic reaction)
- House-Dust mites
- Tobacco smoke
- Mold growth
- Cockroaches
- Outdoor allergens (alternaria and cladosporium)
- Building related triggers
- Foods that contain sulfites
- Air pollution

trigger and symptom severity scoring. The following sessions were dedicated to educating the patient and teaching them better coping skills. For this program or any other program to be successful it is essential that all members of the health care team are involved in the process. In addition it is important that there is clear communication between the patients, home based clinician, and ordering physician or case manager.

Two of the most important elements to our home-based program were the environmental assessment and resulting patient tailored education. Every patient is different and therefore his or her educational needs are also. This is why it is so important to actually go into the patient's home and see first hand the barriers or potential barriers to care. There are considerable environmental factors that can impede adequate care for the asthmatic (Table 2).

Once the respiratory therapist is able to actually see what the environment triggers that exist are they are in a better position to intercede. It is useful to be able to catalog all potential triggers in the home environment by use of a log. Once completed patient focused education regarding trigger remediation and avoidance techniques can be taught. But before this it is essential that the clinician determine what the patient's exposure to the offending allergen actually is, determine how sensitive the patient is to these organisms (usually accomplished with a thorough medical history and skin testing or *in vitro* testing to determine the presence of IgE antibodies), and a determine the clinical significance of any positive allergy tests.

Along with the environmental assessment it is appropriate to determine the degree and frequency of symptoms. This can be accomplished by a detailed discussion with the patient that focuses on exposure to the triggers and resultant symptoms. Once a correlation is determined it is possible to teach intercede. It is entirely possible that the offending trigger may never be entirely eradicated; however it is likely that the patient may decrease many of them.

Common offending triggers of asthma

In the United States more than 60% of all households have either a dog or a cat that resides in the home. As such they are one of the biggest allergens in the home.

The obvious solution is to remove the creature but in many circumstances this is not an option. In such cases it is best to remove the animal from the patient's bedroom and keep the door closed at all times. Even if the animal is removed from the home the patient is still subject to many of the allergens that are left behind as they may still be in the carpeting and upholstery. It may take considerable time to remove the remaining allergens but over time and a concerted effort in cleaning and/or removal of the carpeting and upholstery it is possible to see positive results.

Another common allergen is house-dust mites. House-dust mites are common in most areas except higher elevations and arid areas. House-dust mites are commonly found in mattresses, pillows, carpeting, and upholstered furniture. An easy method to remove these from the area is to wash all bedding at least once a week in hot water. In addition it is useful to instruct patients with children not to leave stuffed animals exposed to the air but rather keep them in a contained environment. In areas of the country where the temperature reaches less than 32 °F, it is useful to take the mattresses or upholstered furniture outside allowing the house-dust mites to be killed by the low temperature. Encasing pillows in an allergen impermeable covering is an essential step that can decrease the possibility of the asthmatic patient coming in contact with the mites. Another successful method to teach patients is to decrease the relative humidity to less than 50% RH.

In the inner city cockroaches are a common trigger for the asthmatic. Cockroaches are often the most difficult to remove from a dwelling. If there is an infestation, use of chemicals such as boric acid, poison baits, and traps often can help. If the dwelling is sprayed with a chemical agent in an effort to fumigate the living area it is important to teach patients not to be in the general area during the treatment or immediately afterwards. Probably 1 of the best steps that can be taken is to educate the patient of the need to keep a clean environment. Cockroaches are attracted to open food containers or exposed garbage.

Home-based education

Again, it is important to note that patient specific education be presented. If there some triggers that are not found in the patient's home, it may not necessary to

spend too much time discussing those triggers. Instead it is appropriate to provide that patient with environmental information that pertains to their home. Keeping the perspective of patient specificity, it is during the one-on-one interview in the home and ongoing discussion that the caregiver can elicit the areas of concern for the patient and caregivers. Our experience has been that many of our patients do not understand the key messages about asthma management. Patients often struggle when trying to put this knowledge into action and often require the respiratory therapist to help them do so.

A demonstration of medication administration is an important tool in any home based program. It is entirely possible that the patient has a less than perfect administration technique with the metered dose inhaler or nebulizer. And just as importantly, they may also not maintain a proper cleaning or disinfection of the devices. Taking the time to observe, critique, and teach are key interventions in the administration of medication in the home, just as may be done in the clinical environment.

Cost considerations

An asthma educational intervention that is directed to children and adults can result in improved economic outcomes. This can be realized immediately and many months after the education occurs.³⁰ It is also likely that his educational component of an asthma disease management program can result in decreased hospital readmissions as well.³¹⁻³³ Asthma Education is an essential component of any asthma disease management program.³⁴ Asthma education is also effective for some of the Medicaid patients in the United States. In Connecticut (USA) a decrease in Medicaid utilization of up to 71% was seen post an asthma education program.³⁵ A home base program can particularly cut costs as well.³⁶

There are costs associated with any educational effort that must be taken into account. These include costs for educational materials, asthma management devices (peak flowmeters, spacers, metered dose inhalers, compressors, nebulizers, diaries, asthma action plans). Additionally, there is a cost in human resources, which must also be taken into account. While it is preferred that asthma education become an essential component of care in the hospital and home, the educational experience must extend beyond. As a result there is a cost for health

care professionals as an ongoing measure. The Cleveland based program that I designed allocated \$50.00 per respiratory therapist home visit. The respiratory therapist was essentially a paid consultant for the home care company. Additional costs include, a disease case manager, office support, a database administrator and analyst, financial accountants, and a medical director. Unless there is enough support to finance these individuals, it may be difficult to offer the service.

It is also essential that all educational offerings be gauged by some outcome measure. Outcome measure will serve as a measurement of the effectiveness of the education. Possible outcome measures include:

- Visits to the emergency department
- Admissions to the hospital
- Missed work/school
- Quality of life
- Pre and post knowledge of asthma management
- Visits to physicians

Impediments to cost recovery

Home-based program come with potential flaws as well. Because the education, intervention, and follow-up occur in the home, the physician must rely on the respiratory therapist to provide much information. It is therefore imperative that quality measures are followed and verified by the sponsoring agency. If high quality education is not assured the patient outcome may be in jeopardy. It is also important that the staff be educated on state-of-the-art asthma management and the essentials on how to teach others. If this does not happen and competency is not verified, potential obstacles for the program could be encountered.

Another consideration is that of establishing and maintaining a source of reimbursement. This may be more difficult when a home-based program is initially started. In the United States some options are to partner with a third party payer and to share the cost savings of the program. Others have opted to charge the third party payer per diem for the services offered. Both come with pro and cons.

Education and self management perspectives

The home-based asthma intervention/education pro-

gram must have an ultimate goal of adequate patient self-management. The ongoing care that any patient receives is directly linked to how well they manage their disease process on their own. As part of any self management program the clinician must teach the patients and caregivers the essential information pertaining to administration of medication, symptom monitoring and self assessment, environmental and control/avoidance techniques, and of course some of the basic facts about asthma that they will need to understand in order to manage the disease adequately.

The marriage of education and home-based programs are key in the management of the disease. In the United States this concept is still in its early stages but is likely to grow over time. In any such program it is essential that outcomes be measured in order to demonstrate that such an intervention actually works.

REFERENCES

- Feldman CH, Clark NM, Evans D. The role of health education in medical management of asthma. Some program applications. *Clin Rev Allergy* 1987;5:195-205.
- Bernard-Bonnin AC, Stachenko S, Bonin D, Charette Rousseau E. Self-management teaching programs and morbidity of pediatric asthma: a meta-analysis. *J Allergy Clin Immunol* 1995;95:34-41.
- Guevara JP, Wolf FM, Grum Cm, Clark NM. Effects of educational interventions for self management of asthma in children and adolescents: A systematic review and meta-analysis. *BMJ* 2003;326:1308-9.
- Choy DK, Tong M, Ko F, Li ST, Ho A, Chan J, Leung R, Lai CK. Evaluation of the efficacy of a hospital-based asthma education programme in patients of low socioeconomic status in Hong Kong. *Clin Exp Allergy* 1999;29:84-90.
- Chen SH, Yin TJ, Huang JL. An exploration of the skills needed for inhalation therapy in school children with asthma in Taiwan. *Ann Allergy Asthma Immunol* 2002;89:311-5.
- NIH Publication No. 97-4051. July 1997.
- NHLBI/WHO Workshop Report: Global Initiative for Asthma Management and Prevention. NIH Pub 02-3659.
- Liu C, Feekery C. Can asthma education improve clinical outcomes? An evaluation of a pediatric patient education program. *J Asthma* 2001;38:269-78.
- ten Thren C, Petermann F. Reviewing asthma and anxiety. *Respir Med* 2000;94:409-15.
- Peterson-Sweeney K, McMullen A, Yoos HL, Kitzman H. Parental perceptions of their child's asthma: management and medication use. *J Pediatr Health Care* 2003;118-25.
- Dolinar RM, Kumar V, Coutu-Wakulczyk G, Rowe BH. Pilot study of a home-based asthma health education program. *Patient Educ Couns* 2000;40:93-102.
- Legorreta AP, Leung KM, Berkbigler D, Evans R, Liu X. Outcomes of a population-based asthma management program: quality of life, absenteeism, and utilization. *Ann Allergy Asthma Immunol* 2000;85:28-34.
- Liu C, Feekery C. Can asthma education improve clinical outcomes? An evaluation of a pediatric asthma education program. *J Asthma* 2001;38:269-78.
- Gibson PG, Coughlan J, Wilson AJ, Hensley MJ, Abramson M, Bauman A, Walters EH. Limited (information only) patient education programs for adults with asthma. *Cochrane Database Syst Rev* 2000;(2):CD001005.
- Petersen DL, Murphy DE, Jaffe DM, Richardson MS, Fisher EB Jr, Shannon W, et al. A tool to organize instructions at discharge after treatment of asthmatic children in the emergency department. *J Asthma* 1999;36:597-603.
- Edmond SD, Reed CR, Graff LG, Clark S, Camargo C. Asthma education in the Emergency Department. *Ann Emerg Med* 2000;36:204-11.
- Ignacio-Garcia JM, Gonzales-Santos P. Asthma self-management education program by home monitoring peak expiratory flow. *Am J Respir Crit Care Med* 1995;151:353-9.
- Behbehani N, Grunfeld A, FitzGerald JM. Health care costs associated with acute asthma: a prospective economic analysis. *Can Respir J* 1999;6:521-5.
- Lawrence G. Asthma self-management programs can reduce the need for hospital-based asthma care. *Respir Care* 1995;40:39-43.
- Conway T, Hu TC, Bennett S, Niedo M. A pilot study describing local residents' perceptions of asthma and knowledge of asthma care in selected Chicago communities. *Chest* 1999;116:229-34.
- Sullivan SD, Weiss KB, Lynn H, Mitchell H, Kattan M, Geogen PJ, et al. The cost-effectiveness of an inner-city asthma intervention for children. *J Allergy Clin Immunol* 2002;110:576-81.
- Meng YY, Leung KM, Berkbigler D, Halber RJ, Legorreta AP. Compliance with US asthma management guidelines and specialty care: a regional variation or national concern? *J Eval Clin Pract* 1999;5:213-21.
- Pachter LM, Weller SC. Acculturation and compliance with medical therapy. *J Dev Behav Pediatr* 1993;14:163-8.
- Manson A. Language concordance as a determinant of patient compliance and emergency room use in patients with asthma.

- Med Care* 1988;26:1119-28.
25. Expert Panel Report II: Guidelines for the diagnosis and management of asthma. NIH Publication No. 1997;97-4051.
 26. Worstell M, Asthma: individual patient perspective and current unmet needs. *Clin Exp Allergy* 2000;30:11-5.
 27. Reis AL, Kaplan RM, Limberg TE, Prewitt LM. Effects of pulmonary rehabilitation on physiologic and psychological outcomes in patients with chronic obstructive disease. *Ann Intern Med* 1995;122:823-32.
 28. Clark NM, Nothwehr F, Gong M, Evans D, Maiman LA, Hurwitz ME, *et al.* Physician-patient partnership in managing chronic illness. *Acad Med* 1995;70:957-9.
 29. Lewarski J, Chao J, Stegmaier J, Kallstrom T, *et al.* HME based program reduces the cost of care. *Respirat Care* 1998; 43:864.
 30. Astra Drace AB. Is asthma self management cost effective? *Patient Educ Couns* 1997;32:97-104.
 31. Ross S, Togger D, Desjardins D. Asthma disease management program cuts readmission. *Hosp Case Manag* 1998;16: 197-200.
 32. Kallstrom T. A pediatric asthma fast tract can reduce the number of patients admitted to the acute care unit. *Respirat Care* 2000;45.
 33. Lawrence G. Asthma self-management programs can reduce the need for hospital-based asthma care. *Respirat Care* 1995; 40:39-43.
 34. Making a difference in the management of asthma: A guide for respiratory therapists. NHI pub No. 02-1964. May 2003.
 35. Anonymous. Simplified, one-on-one asthma education cuts Medicaid utilization up to 71%. *Public Sect Contract Rep* 1998;4:38-40.
 36. Anonymous. Home-taught pediatric asthma program improves outcomes, cuts hospital, physician visits. *Health Care Cost Reengineering Rep* 1997;2:40-3.