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Determining Evidence-based Practices in Asthma Management

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By:

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DEDICATION

This project is dedicated to my family and friends that provided the motivation necessary to finish this research.

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Abstract

Objective: One aim of this study will focus on determining what are evidence-based studies in asthma control. A second aim focuses on determining which asthma interventions, self-monitoring tools and asthma management programs have shown to be the most significant in improving outcomes in patients with asthma. Recommendations will be made to future asthma self-management programs based on the findings.

Methodology: The review of 15 evidence-based research studies is used to identify and analyze the best asthma self-management practices to be implemented in a community health education program. Using the Brownson framework a weighting schema was created based on the level of scientific evidence used for each study. This framework identified each study as evidence-based, effective, promising, or emerging. Five categories of interventions commonly used in asthma programs were identified for analyzing the studies identified through the literature searches.

Results: Three studies were evidence-based, two effective, nine promising, and 1 emerging. All 15 programs analyzed in this study were found to incorporate asthma education at some point or another throughout their program. Eight of the studies used six or more asthma education interventions. A total of 11 instruments were used in 14 studies. Eight of the 12 studies that incorporated the peak flow meter into programs showed improvements in increasing patient's peak flow results. The survey sub-category is the most frequently used tool in the measurements and follow-up category with 10 programs using surveys as evaluation and/or patient assessments. A total of four studies used registered nurses as compared to doctors, pharmacists, certified asthma educator and a trained investigator that were used in one study each.

Conclusion: Assessing severity should be done through the use of surveys or peak flow meters. It is recommended that at least one home visit be made. Communication between participant's health care providers allows for repetition and reinforcement of asthma management practices. Action plans should be done with every participant and reported to the participant's primary health care provider. Monitoring quality of life, asthma exacerbations, and pharmacotherapy is recommended.

Introduction

Asthma is one of the most poorly managed diseases in America, with a widespread misunderstanding about cause and treatment. Frequency and severity of symptoms, limitations on activities, use of quick-relief medications and other indicators show that the U.S. is missing the mark in terms of asthma care. It is a major cause of frequent work absences, emergency room visits, and hospitalization (American Lung Association, 2005). In addition to causing significant morbidity and affecting the quality of life of those with from the condition, asthma imposes a significant burden on health-care systems (Fuhlbrigge, Admas, & Guilbert, 2002). The annual cost of asthma is estimated to be nearly $30 billion (CDC, 2007). These costs include the direct expenditure of treating asthma and not the indirect costs such as absentee time.

The number of people with asthma in the United States grew by 4.3 million from 2001 to 2009 accounting for about 25 million Americans or 8% of the population (CDC Vital Signs, 2011). Asthma is prevalent among adults but they often under-report symptoms, have poor perception of asthma severity, and attribute breathlessness to the normal effects of aging (Cortes, Lee, Boal, Mioin, & Butler, 2004). Lack of education, access to health insurance, and other socioeconomic barriers contribute to the under-reporting, poor beliefs and values toward the severity of one's asthma. This low perception for the importance of asthma control among adult's results in higher health care costs and longer emergency room visits not only for asthmatics, but also for the entire U.S. population.

Asthma prevention and education are identified as high priorities with the national health plan, Healthy People 2020. Objectives for Healthy People 2020 include emphasis on activities to minimize environmental triggers, reduce hospitalizations and improve functional capacity (Healthy People 2010). Several types of asthma education programs have been developed over

the last couple of decades to improve these priorities. A majority of asthma programs are designed around the notion of comprehensive use of pharmacological therapy for long-term management. In addition to pharmacological therapy, self-management education within programs has become vital in improving patients' sense of control and personal responsibly for their asthma.

Dayton, Ohio has been identified as a challenging place to live with asthma. According to Asthma Capitals 2011, an annual research project of the Asthma and Allergy Foundation of America (AAFA) identifies Dayton, Ohio as the fifteenth most challenging places to live with asthma (AAFA, 2011). With a higher than average prevalence of asthma and a small amount of asthma specialists, resources for asthmatics in Dayton are few and far between. Educational programs designed specially for the learning styles of the adult population fall short. Not only is it important to make resources available in the Dayton area for asthma management, but also the quality and significance of a program is vital in order to prevent illness, injury and unnecessary deaths from asthma in the Dayton region. Deaths from asthma are more common than expected and evidence shows that they are completely preventable through even brief asthma education interventions.

Statement of Purpose/Research Question

The purpose of this project was to review asthma management programs and determine if they are evidence-based, effective, promising, or emerging. A second aim focuses on determining which asthma interventions and self-monitoring tools in asthma management programs have shown to be the most significant in improving outcomes in patients with asthma. Recommendations are made for future asthma self-management programs based on the findings.

Literature Review

The number of people with asthma in the United States grew by 4.3 million from 2001 to 2009 accounting for about 25 million Americans or 8% of the population (CDC Vital Signs, 2011). Asthma also disproportionately affects under-represented minority populations, with African Americans and Hispanics having higher rates than other groups (Cloutier, 2008). Current asthma prevalence is highest -among blacks (10.2 percent), and Hispanics (6.8 percent) (CDC, 2007). African Americans are three times more likely to be hospitalized from asthma and three times more likely to die from asthma. African American women have the highest asthma mortality rate of all groups, more than 2.5 times higher than Caucasian women (National Institute of Allergy and Infectious Disease, 2001).

Asthma is a chronic inflammatory disorder of the airways within the lungs. Asthma has a genetic origin, meaning it is a disease that one is born with and passed down from generation to generation (AAFA, 2005). During normal breathing, the airways to the lungs are fully open, allowing air to move in and out freely (AAFA, 2005). People with asthma have inflamed airways that become narrowed then blocked and can result in what is commonly known as an asthma attack. Asthma attacks occur when inflammation within the airways causes symptoms such as difficulty breathing, wheezing, or chest tightness. Asthmatics airways are extremely sensitive to things known as “triggers” that typically do not bother people without asthma. Triggers can range from substances that cause allergies, irritants in the air, respiratory infections, exercise, weather, expressing strong emotions, and some medications. Each asthmatic can react differently to these triggers. Some only experience asthma symptoms when exposed to one trigger, while others have more severe episodes when exposed to multiple triggers (AAFA,

2005). Not all episodes occur right after a person is exposed to a trigger, but can be delayed depending on one's sensitivity.

Asthma is divided into two types: allergic (extrinsic) asthma and non-allergic (intrinsic) asthma. Both extrinsic and intrinsic asthma are characterized by airway obstruction (blockage), however, the mechanisms or the trigger of an asthma attack differs. Factors that are not related to allergies, such as anxiety, exercise, cold air, or stress are triggers for intrinsic asthma and do not involve the immune system in the reaction. However, extrinsic asthma is triggered by an allergic reaction and affects over 50 percent of the asthma suffers (AAFA, 2005). Common inhaled triggers for extrinsic asthmatics are pet dander, mold, and dust mites also known as environmental triggers or biological triggers.

Diagnosis

The number of cases of asthma is increasing in all age groups. Asthma is under diagnosed because the symptoms can impersonate other illness or diseases. Chronic obstructive pulmonary disease (COPD) is one such illness that can be confused with asthma. COPD is a progressive disease (meaning it gets worse over time) that makes it hard to breathe (NHLBI, 2010). COPD causes extremely similar symptoms to asthma including wheezing, shortness of breath, and chest tightness. Other illness with similar symptoms includes hiatal hernia, stomach problems, or rheumatoid arthritis (AAFA, 2005). Asthma symptoms can appear at any time in life, but is commonly diagnosed in children, who can carry the diagnosis throughout life (long-standing asthma). Adult onset asthma may or may not be caused by allergies, but evidence shows that it is partly determined by heredity (AAFA, 2005). Several factors in adulthood put one more at risk for to asthma including women over the age of 20 (hormonal fluctuations),

obesity (a significant increase in risk), current illnesses, viruses or infections, and allergies. Allergies account for at least 30 percent of adult asthma cases (AAFA, 2005).

An asthma diagnosis involves a history, a physical examination and a lung function test. A history is when the doctor documents the patient's asthma and allergy related family history in their medical records. The physical examination occurs when the doctor is listening to a patient's lungs and examining the nasal and throat passageway. A lung function test is when a doctor uses and instrument known as a spirometry (spirometer) to check how the lungs are working. This test measures how much air you can breathe in and out along with how fast air can be blown out (NHLBI, 2011). Pulmonary function tests (PFT) are a group of tests that measure how well the lungs take in and release air and how well they move gases such as oxygen from the atmosphere into the body's circulation (NHLBI, 2011). In addition to a PFT, allergy testing may also be conducted to assist in the diagnosis of asthma. Once diagnosed primary physicians may also refer a newly diagnosed asthmatic to a pulmonologist or an allergist. Pulmonologist specializes in lungs while the allergist focuses on allergies. Either healthcare provider has the potential of doing specialized testing or treatment to control asthma triggers.

Once asthma is diagnosed, it is important for a doctor to assess the level of severity. The level of severity can range from intermittent, mild, moderate, or severe. The doctor, following the patient's history, physical exam, and lung function test, determines the level of severity. The level of severity will help determine the type of treatment necessary (NHLBI, 2011). Medicines are usually considered regardless of ones level of severity.

Triggers

The environment has proven to be severely problematic and plays a huge role in determining how well or poorly they can control their asthma. Environmental triggers are both

chemical and biological. Chemical triggers are exposures such as environmental tobacco smoke (ETS), pesticides, and volatile organic compounds (Postma, Smalley, Ykarra, & Kieckhefer, 2011). As mentioned above, biological triggers include exposures to dust mites, molds, rodent and cockroach feces, and animal dander (Postma et al., 2011). Studies have shown that avoiding exposure to these triggers prevents asthma exacerbations (attacks) and simple environmental interventions designed to avoid exposures to these contaminants can help control ones asthma. Interventions to decrease environmental triggers for asthma are multifaceted, contributing to barriers determined by socioeconomic status.

Socioeconomic Status

Socioeconomic status plays have a large role in increasing healthcare barriers and often time's results in poor asthma control and management. Low-income adults and families often struggle to implement asthma recommendations due to a lack of resources, competing priorities, and a lack of control over their indoor environment (Postma et al., 2011). Characteristics include outdoor air pollution (especially diesel exhaust fumes); crowding (which may predispose people to viral infections); poor housing (which results in the potential for increased indoor exposures to cockroach and rodent infestations); the presence of humidifying device, gas range, or oven; and increased tobacco smoke exposure (Cloutier, 2008).

Inequities surrounding socioeconomic status and housing quality, discrimination, and lack of family and community support contribute to such disparities in asthma care. However, the racial and ethnic disparities in asthma prevalence and severity cannot be explained entirely by environmental, social, cultural, and economic factors (Collins, 2004). Studies of the genetics of asthma found a number of target candidate genes have been associated with both asthma and pathways associated with treatment (Barnes, Grant, & Hansel, 2007). Evidence for linkage of

asthma to various candidate genes has been found in both African Americans and Hispanics (Choudhry, Ung, & Avila, 2005). In terms of treatment responses, T-lymphocyte responses to corticosteroids may be less in African Americans than in White individuals (Cloutier, 2008). Thus, making African Americans more likely to have a poor response to inhaled corticosteroids (Cloutier, 2008).

Asthma Management

Asthma medicines can be taken in a pill form, but most are taken using a device called an inhaler (NHLBI, 2011). These medications are divided into two types, quick-relief and long-term control. Quick-relief medications are used to help relieve asthma symptoms such as wheezing, coughing, or tightness of the chest that occur rapidly. Inhaled short-acting beta2-agnoists are the first choice for quick relief because they are inhaled directly to the lungs and are only used when symptoms occur (NHLBI, 2011). Long-term asthma medications are also commonly referred to as inhaled corticosteroids. Inhaled corticosteroids are taken every day to prevent and reduce airway inflammation and decrease the amount of mucus in the lungs (AAFA, 2011). By reducing the inflammation in the airways it helps to prevent the chain reaction that causes asthma symptoms (NHLBI, 2011). Within the past decade, clear evidence has supported the use of including long-term control medications (inhaled corticosteroids) along with a fast acting inhaler. The use of long-term corticosteroid therapy has been instrumental in decreasing morbidity and mortality in asthma, and the emerging use of steroids is indicated in all age groups (Chotirmall et al., 2009).

Asthma is a long-term disease that cannot be cured. Having control or “managing” the disease is vital for treatment. Asthma is one of the most poorly managed diseases in America, with a widespread misunderstanding about cause and treatment. Asthma management is falling

far short of the 2010 goals established by the National Heart, Lung, and Blood Institute (NHLBI), part of the National Institutes of Health (Asthma in America, 2011). The goals set by NHLBI include no sleep disruption, no missed school or work, no (or minimal) need for ER visits or hospitalizations, maintain normal activity levels and have normal or near normal lunch function. It is important for a community asthma program to assess factors described as possible causes for the increased morbidity and mortality including poor patient understanding of the disease process, inappropriate medication use, non-adherence with prescribed preventive medications (particularly inhaled corticosteroids), and poor inhaler technique (Legorreta, Leung, Berkbigler, Evans, & Liu, 2000).

Asthma Self-Management Programs

Self-management programs refers to self-monitoring changes in disease severity, appropriate knowledge about asthma and it's provoking factors, knowledge of medications, adherence to inhales medication, recognition of symptoms, and self-adjustment of medical therapy (Klein et al., 2001). Self-management implies a process of change from a traditional physician-dominated consultation to where responsibility is in part assumed by the patient (Smith et al., 2007). The increase in responsibility presumes that all patients have the ability to problem solve their personal health issues (Smith et al., 2007). One study found that different types of patients were able to demonstrate varying levels of responsibility (Adams, Smith, & Ruffin, 2001). However, another study found patients having different approaches to the amount of responsibility and involvement in treatment decisions with many not achieving the level of involvement they would have liked (Caress, Woodcoc, & Beaver, 2002). For these reasons, it may or may not be difficult for patients to be successful at managing their asthma without the proper tools.

Self-management tools like individualized asthma treatment plans (written action plans), peak flow meters, metered-dose inhaler monitoring devices, follow-up care (telephone, mail, or face-to-face), and problem solving have shown to be useful and extremely productive among community asthma programs. Asthma treatment plans are considered today to be an essential component of the management of asthma as cited in two expert panels (Myers, 2002). A study done by Kolbe, Vamos, James, Elkind, and Garrett (1996) also demonstrated that utilizations of written asthma treatment plans and education are successful in eliciting positive behavior outcomes. While style and formatting vary, most asthma treatment plans are generic in the sense that they commonly offer explanations of symptoms and precipitating factors of asthma, measures of lung function, treatment with medication and adverse effects, and personal written guidelines for self-adjustment or medication (Myers, 2002). Asthma treatment plans allow patients to practice problem solving by communicating hypothetical situations. Treatment plans focusing on the "realistic" problems and situations that require the leaner to be active in the decision-making process supports the patients development of problem solving skills for successful self-management.

Peak Flow Meters (PFM) have received credit as an effective tool for identifying the chronic severity of asthma as well as detecting exacerbations and monitoring responses to changes in therapy and medications (Myers, 2002). The practice of peak flow monitoring in the home has been and continues to be recommended by experts as an objective tool to assess lung function status in patients with moderate to severe persistent asthma in the ambulatory setting (Myers, 2002).

The ability of clinicians and asthma patients to determine if the contents of a canister (part of the inhaler that stores the medication) are truly empty has been a dilemma. Due to this

issue metered-dose inhalers (MDI) were created. The development of these devices were brought about in part due to the hypothesis that clinicians were capable of monitoring patient adherence or compliance to medical treatment regimens (Myers, 2002). However, the implication of these devices as a tool for asthma self-monitoring is a distinct possibility as they could provide reliability in accurately recoding the reporting the date, time and number of MDI actuations (Myers, 2002).

Follow-up care is an integral part of asthma self-management programs, but is often times forgotten or not conducted due to lack of resources. It important to highlight that even the a simple and relatively inexpensive functional evaluation, such as PFM, offers the ability for health care providers to predict the time needed to achieve good control status and freedom from asthma symptoms, allowing a better strategy for treating asthma patients in the public health system (Costa et al., 2008). With follow-up, brief interventions or teachable moments can occur allowing for the participants to improve self-care behavior and self-efficacy, of which are important in achieving continuous asthma control.

A challenge facing health care providers is to implement and evaluate asthma care programs designed to fit individual and local needs (Costa et al., 2008). There have been a number of descriptive studies that have attempted to identify key determinants of effective asthma education, but these factors do not appear to have been evaluated in subsequent studies of asthma education (Smith et al., 2007). Asthma programs have used a wide variety of approaches such as the use of treatment plans, peak flow meters, learner-centered teaching, and metered-dose inhalers in attempt to improve quality of life. With the vast number of tools or initiatives used among programs, the question becomes which asthma interventions or combinations have shown to be the most significant in adult asthma management.

Evidence-based Public Health

Defining the value or usefulness of evidence-based public health (EBPH) can sometimes be in the eye of the beholder and vary by stakeholders. In general EBPH is the result of a complex cycle of observation, theory, and experiment (Brownson, Fielding, & Maylahn, 2009). Several authors have defined types of scientific evidence of public health practice. Brownson, Fielding, and Maylahn (2009) describe these as:

- Type 1 evidences defines the causes of diseases and the magnitude, severity, and preventability of risk factors and diseases. It suggests that "something should be done" about a particular disease or risk factor.
- Type 2 evidence describes the relative impact of specific interventions that do or do not improve health, adding "specifically, this should be done."
- Type 3 evidence shows how and under which contextual conditions interventions were implemented and how they were received, thus informing "how something should be done."

Understanding the types of evidence was important when creating criteria for determining which studies and interventions used were evidence-based practices. Using sources of type two evidence, shown in Table 1, a criterion was created for choosing studies to review.

Table 1. Typology for classifying interventions by level of scientific evidence

Category	How established	Considerations for the level of scientific evidence	Data source examples
Evidence-based	Peer review via systematic or narrative review	Based on study design and execution External validity Potential side benefits or harms Costs and cost-effectiveness	Community Guide Cochrane reviews Narrative reviews based on published literature
Effective	Peer review	Based on study design and execution External validity Potential side benefits or harms Costs and cost-effectiveness	Articles in the scientific literature Research-tested intervention programs (123) Technical reports with peer review
Promising	Written program evaluation without formal peer review	Summative evidence of effectiveness Formative evaluation data Theory-consistent, plausible, potentially high-reach, low-cost, replicable	State or federal government reports (without peer review) Conference presentations
Emerging	Ongoing work, practice-based summaries, or evaluation works in progress	Formative evaluation data Theory-consistent, plausible, potentially high-reaching, low-cost, replicable Face validity	Evaluability assessments Pilot studies NIH CRISP database Projects funded by health foundations

Evidence-based or best practices are multi-faceted concepts that centers on the validation of decision making within public health. It is an important concept not just used in public health, but other subjects such as research, design and many others. It is especially important for the field of public health because similar to evidence-based medicine it uses the best and current evidence to support making decisions about a patient's or a communities care. The review of evidence-based research and literature can be used to identify and analyze which asthma self-management practices are the best for implementing a community health education program. Self-management refers to self-monitoring changes in disease severity, appropriate knowledge about asthma and it's provoking factors, knowledge of medications, adherence to inhaled medication, recognition of symptoms, and self-adjustment of medical therapy (Klein et al., 2001).

Methodology

This research uses peer reviewed research studies to evaluate asthma programs to determine what combination of treatment, education, practices, and procedures provides the optimal evidence based outpatient community based asthma control program.

The term peer review refers to the evaluation of research by colleagues in the discipline (Hernon & Schwartz, 2006). The standard is that researchers with knowledge about a topic or problem being studied, the professional (scholarly) peers of the authors, render a judgment about the work. The peer reviewer evaluates the uniqueness of the study, its contribution to the professional literature, the adequacy of the research design, and the methodology. The reviewer also conveys to the editor their assessment of the clarity and effectiveness of the written presentation (Hernon & Schwartz, 2006).

Research articles for this study were obtained by conducting literature searches in peer-reviewed databases. Databases included PubMed, Medline, EBSCOhost Academic Search Premier, and Google Scholar. Any studies that was not peer reviewed was eliminated. This research focuses on studies of adult outpatient asthma programs that included participants who were adults (age 18 or older) that were published in 2000 or later. Initially, there were 12 research articles identified that met these criteria. After adjusting the publishing year to 1990 or later, three significant articles worth including were identified, making for a total of 15 research articles.

Evaluation Criteria for Evidence-based Public Health

1. Study design – A study design is a specific plan or protocol for conducting the study, which allows the investigator to translate the conceptual hypothesis into operational practice (Friis & Sellers, 2008).

There are two main types of study design, descriptive and analytic. Analytic designs are concerned with reasons for relatively high or low frequency of disease in specific population subgroups and used for hypothesis testing that requires the collection of new data (Friis & Sellers, 2008). Descriptive designs characterize the amount and distribution of disease within a population and are used for hypothesis forming (Friis & Sellers, 2008).

2. External validity – External validity refers to the question whether results are generalizable to persons other than the population in the original study (Dekkers, Elm, Algra, Romijn, & Vandenbroucke, 2010).
3. Side benefits or harms – Includes lists or discussions of potential side benefits and harmful reactions for the participants within a study as a result of a specific intervention.
4. Cost and cost-effectiveness – Signify that a study discussed the costs of the program as well as the determination of usefulness. Discussion of cost implications or return on investment (ROI), related to the patient, intervention, or program as a whole.
5. Theory – Public health social behavioral theories are a set of interrelated concepts, definitions, and propositions that present a systemic view of events (behaviors) by specifying relations among the variables in order to explain and predict the events (Glanz & Rimer, 2008). Social Cognitive Theory (SCT) and the Trans Theoretical Model (TTM) were the only two theories used among the studies.

Table 2 was used to help evaluate studies based on these criteria. If a study discussed one of the above evaluation criteria it was given a score of 1. If a study did not discuss one of the above criteria they received a dash, indicated no score was given.

Using the Brownson et al. (2009) framework a weighting schema was created based on the level of scientific evidence used for each study. This framework provides the basis for weighting studies based on data source. Based on data source a weighted score was assigned to each evaluation criteria identified for each study. The overall score is based on how studies incorporate the tenets of evidence-based research into their design. The key evaluation criteria are 1) study design, 2) external validity, 3) side benefits, 4) cost-effectiveness, 5) theory.

Weight	Description of Data Sources for Levels of Scientific Evidence
4	Evidence-based data sources (*Community Guide*, Cochran reviews, Narrative reviews based on published literature (review articles)
3	Effective data sources (Articles in scientific literature, research tested intervention programs, Peer reviewed Technical Reports)
2	Promising data sources (State or federal reports – not peer reviewed, conference proceedings)
1	Emerging sources – (Evaluation assessment, Pilot studies, NIH CRISP database)

Scoring

Olajos-Clow, Costello, and Lougheed (2005) (Study 1) used state and federal government reports that were not peer reviewed as the data source for the scientific evidence used for the intervention. This data source is in the promising category, a weight score of two was given for each of the key components used by the program designers. The weights were combined with the scores assigned based on whether studies discussed analytic criteria. For studies that evidence based data sources 4 points were given for every criterion met, for studies that used effective data sources 3 points were given for every criterion met, and so on. Scores were then weighted based on the source of the data (see Table 1) used to design the study. Table 2 shows the data source weight and the criteria identified for each study reviewed.

Table 2. Evaluation Criteria Identified for Studies Reviewed

Study	Data source weight	Study design	External validity	Side benefits	Cost effective-ness	Theory based
1. Olajos-Crow, 2005	2	1	1	1	-	1
2. Costa, 2008	4	1	-	1	1	-
3. Urek, 2005	2	1	-	1	-	-
4. Marijanian, 1999	2	1	-	1	-	-
5. Lind, 2006	2	1	-	1	1	-
6. Tousman, 2007	4	-	1	1	-	1
7. Martin, 2009	1	1	-	1	1	1
8. Windsor, 1990	2	1	-	-	1	-
9. Choi, 2010	2	1	-	1	-	-
10. Huang, 2008	3	1	-	1	-	1
11. Brown, 2006	2	1	1	1	-	-
12. Smith, 2007	2	1	-	1	-	1
13. Legorreta, 1999	2	1	1	1	1	-
14. Galbreath, 2008	4	1	-	-	1	-
15. Palen, 2001	4	1	1	1	-	1

Using this scoring schema the lowest score possible was a 1 and the highest was 16. Each study was carefully examined following the selection process to determine the total overall score. As seen in Table 2 under overall score, each study was scored then categorized based on the scale below:

Table 3. Overall Evidence Score Categories

Evidence Category	**Score**
Evidence-based	13 – 16 points
Effective	9 – 12 points
Promising	5 – 8 points
Emerging	1 – 4 points

Interventions Categories and Sub-Categories

Five categories of interventions commonly used in asthma programs were identified for analyzing the studies identified through the literature searches. The intervention categories are focus areas of asthma programs used throughout the literature. Sub-categories were created for two of the intervention categories as a way to group and analyze more effectively. Intervention categories and subcategories are:

Asthma education – this intervention category includes the use of educational tools or knowledge based activities to improve a participant's comprehension of asthma management.

- Knowledge objective sub-categories - objectives are those addressing a participant's ability to learn a new skill or gain knowledge in asthma management

Asthma instruments – this intervention category consists of any device used during a program to assist in improving asthma severity.

Measurements/follow-up - this intervention category consists of methods used to evaluate the program or judge the effectiveness of interventions.

- Survey sub-categories - are different types of surveys. Each survey was categorized based on the topic of the questionnaire.

Guidelines – Studies that used guidelines throughout the program planning process, intervention, or evaluation were identified. The name of each organizational guideline was listed.

Health assessments/interviews – this category shows which studies used program assessments and the type of medical professional that was most common during these interviews. Interventions in this category also serve as an evaluation measure among programs.

Information about studies was entered into a Microsoft Excel spreadsheet. A numbering system was created to help keep track of information and the study from which it came. The intervention category heading is highlighted in yellow with the study number, each in a separate column. Below the category title heading, interventions are alphabetically listed in separate rows with a sequential number assigned to each. To effectively organize and keep necessary

interventions in the proper group, asthma education and measurements/follow-up intervention categories have sub-categories. Sub-categories are highlighted in green to distinguish from the overall intervention category. Sub-categories are listed in sequential order along with a decimal to differentiate from the intervention categories. Assigning numbers to each intervention and sub-category intervention allowed for sorting in the excel document to analyze data.

A conclusion tab was also created in the Excel document to list the significant findings for each study. Significant findings are conclusions or discussions that relate to the specific interventions listed in the categories tab. These conclusions helped to identify which interventions were the most successful at reducing asthma severity and increasing asthma self-management practices in participants. Interventions with the most promise at increasing asthma self-management skills are the ones that will be most ideal for developing a community asthma self-management program.

Results

Table 4 shows the weighted values and total scores for each of the 15 studies reviewed for this project. Scores ranged from 4 to 16. With a score of 16, study 15 was the one study to be in the evidence-based category. Three studies were considered effective. The promising category was the largest with six studies, while five studies were emerging.

Table 4. Studies by Evaluation Criteria and Evidence Total Score

Study	Data Source	Study design	External validity	Side benefits	Cost effective-ness	Theory based	Total
1. Olajos-Crow, 2005	2	2	2	2	-	2	8
2. Costa, 2008	4	4	-	4	4	-	12
3. Urek, 2005	2	2	-	2	-	-	4
4. Marijanian, 1999	2	2	-	2	-	-	4
5. Lind, 2006	2	2	-	2	2	-	6
6. Tousman, 2007	4	-	4	4	-	4	12
7. Martin, 2009	1	1	-	1	1	1	4
8. Windsor, 1990	2	2	-	-	2	-	4
9. Choi, 2010	2	2	-	2	-	-	4
10. Huang, 2008	3	3	-	3	-	3	9
11. Brown, 2006	2	2	2	2	-	-	6
12. Smith, 2007	2	2	-	2	-	2	6
13. Legorreta, 1999	2	2	2	2	2	-	8
14. Galbreath, 2008	4	4	-	-	4	-	8
15. Palen, 2001	4	4	4	4	-	4	16

Asthma Education

Increasing the knowledge of participants is a large part of any community health program. Asthma programs were found to be no exception. All 15 programs analyzed in this study were found to incorporate asthma education at some point or another throughout their program. Some programs went to great lengths to incorporate multiple teachable opportunities, while others put their focus elsewhere. Table 5 indicates how many asthma education interventions and knowledge objectives (sub-category) were used by each study. Asthma education interventions included education in group sessions, one-on-one sessions, and passing out educational literature, educational videos and the sub-category, knowledge objectives. Knowledge objectives are listed in a separate column and address the participant's ability to learn. Knowledge objectives include education on cigarette smoke avoidance, exacerbations, exercise, goal setting, inhaler technique and use, medication, physiology of asthma, environmental symptom control, and trigger avoidance. Total score was included in Table 5 for each program to show whether the program was considered evidence-based, effective,

promising, or emerging. Based on the evidence category scale a studies total score indicates the classification category of evidence-based, effective, promising, or emerging.

Eight of the studies used six or more asthma education interventions. Of these eight studies, three are evidence-based, one is effective, three are promising and one is emerging. The studies conducted by Smith et al. (2007) and Palen et al. (2001) tie with a total of nine asthma education interventions. The studies conducted by Olajos-Crow et al., (2005) and Martin et al. (2009) tie for the second with a total of eight interventions. The remaining seven studies used between three and five asthma education interventions. This included no evidence-based or emerging studies, one effective, and six that were promising. The four studies that used the highest number of interventions in their research also used the highest number of knowledge objective sub-category interventions. Palen et al. (2001) had a total of seven sub-category interventions while studies Olajos-Crow et al. (2005), Martin et al. (2009), and Smith et al. (2007) each report six sub-category interventions.

Table 5. Studies by Asthma Education Intervention Categories and Level of Evidence-based Sources

Study	Number of Interventions	Number of Knowledge Objectives	Total Score
15. Palen, 2001	9	7	16 - Evidence-based
6. Tousman, 2007	6	5	12 - Effective
2. Costa, 2008	7	5	12 - Effective
10. Huang, 2008	7	4	9 - Effective
14. Galbreath, 2008	3	2	8 - Promising
1. Olajos-Crow, 2005	8	6	8 - Promising
13. Legorreta, 1999	4	1	8 - Promising
12. Smith, 2007	9	6	6 - Promising
11. Brown, 2006	4	4	6 - Promising
5. Lind, 2006	3	4	6 - Promising
3. Urek, 2005	7	5	4 - Emerging
9. Choi, 2010	5	4	4 - Emerging
8. Windsor, 1990	5	2	4 - Emerging
4. Marijanian, 1999	4	4	4 - Emerging
7. Martin, 2009	8	6	4 - Emerging

The most top 4 asthma education interventions were from the subcategory of knowledge objectives. This most common intervention medication education was included in 14 studies. The second most used intervention was trigger avoidance education used in 11 of the 14 studies. Inhaler technique and use was the third highest intervention with uses in 10 studies. Nine out of the 14 studies educated about exacerbations or attacks. All 15 studies but one were described the knowledge objectives used.

Asthma interventions that are not education oriented were less commonly used but play an important role in asthma control programs. Literature and one-on-one sessions were used among tied for the fifth most commonly used intervention with eight studies. Group sessions, one-on-one sessions, educational videos and environmental symptom were each used seven times throughout the studies. These four tied as the sixth most commonly used interventions.

Even though the one-on-one intervention were used slightly more than group sessions, it is important to note that four of the studies used a combination of the two. Urek et al. (2005), Tousman, Zeitz, Taylor, and Bristol (2007), Martin et al. (2009), and Windsor et al. (1990) used both one-on-one and group sessions when working with asthma patients. This approach was found to be more successful in improving asthma knowledge than using one or the other. Urek et al. (2005) split participants into three groups: asthma school (group sessions), individual verbal instructions (one-on-one), or a program combining the asthma school and individual. He found the completion of programs in asthma school in combination with individual verbal instructions significantly increased general asthma-related knowledge and awareness (Urek et al., 2005). This was consistent with the findings of the other three studies using a combination of group and one-one-sessions.

Asthma Instruments

Asthma instruments are important because health professionals often use these devices as a visual tool to educate participants about their use. A total of 11 instruments were used in 14 studies. Only one study did not use asthma instruments and focused on asthma education intervention alone. The asthma instruments used include:

- 24-hour Registered Nurse hotline
- Action management plan
- Corticosteroids
- Diary/Record logs
- Hypothetical scenarios or problem solving
- Metered dose inhaler
- Nebuliser
- Peak flow meter
- Rescue inhaler
- Relaxation techniques
- Spacer

The use of many of these instruments is also recommend by the National Heart, Lung, and Blood Institute (NHLBI) and will be discussed later. Table 6 shows the number of asthma instruments in each of the 15 studies.

Table 6. Studies by Asthma Instruments Intervention Categories and Level of Evidence-based Sources

Instruments Used	Study Number	Total Studies
1. Peak Flow Meter	2, 3, 4, 5, 8, 9, 10, 11, 13, 14, 15	11
2. Action Plan	1, 3, 5, 7, 9, 10, 11, 14, 15	9
3. Spacer	2, 3, 4, 7, 11, 13, 14	7
4. Diary/Record Log	3, 4, 9, 10, 13, 15	6
5. Rescue Inhaler	2, 3, 4, 5, 6, 15	6
6. Corticosteroids	1, 2, 3	3
7. Problem Solving	6, 7, 15	3
8. RN Hotline	5, 14	2
9. Meter Dose Inhaler	4, 9	2
10. Relaxation	3, 6	2
11. Nebuliser	4	1

The peak flow meter was the most common instrument used for self-management in 12 studies. Peak flow meters were commonly used among the studies as an inexpensive functional evaluation tool to assess the severity of the patient's asthma and to predict the amount of time needed to achieve good control and become free from asthma symptoms. In six of the 12 studies

each use of the peak flow meter was used to create an opportunity for an educational intervention. Use of the peak flow meter in combination with education was shown to be a more effective strategy in treating a patient's asthma. Peak flow meters were found to be helpful for patients who had difficult perceiving symptoms and a history of severe exacerbations or moderate or severe asthma. Eight of the 12 studies that incorporated the peak flow meter into programs showed improvements in increasing patient's peak flow results. One study that was primarily conducted in-group sessions used peak flow results as encouragement and motivation through the means of social support. All but one study that used peak flow meters showed improvements in at least one of the following criteria:

- Quality of life
- Self-efficacy
- Survey scores
- Asthma management – self-care behaviors

Researchers reported that these improvements were a result of the use of the peak flow meter or the combination of peak flow meter with education.

Asthma action management plans were the second most common instrument used. Nine studies used action management plans. It was commonly acknowledged across the nine studies that with the guided help of either peers or individual health care professionals action plans allowed participants to take charge of their asthma. Through the help of the action plans, participants in five of the nine studies felt more prepared, confident, and more likely to change their behavior increasing their ability to management their asthma. Creating an action plan in conjunction with a health care provider was specifically helpful for adults that had been newly diagnosed and were unsure about their ability to control their asthma. In two of the nine studies action plans generated educational opportunities, similar to the peak flow meter. It was found in

these two studies that a significant amount of people felt more prepared and confident after completing their asthma action plans.

Diaries or record logs were tied with spacers for the third most used instrument; both were used in seven studies. Diaries were found to be helpful for patient's wanting to take an active role in their self-management practices, but unsure where to start. Palen et al. (2001) identified that going through diaries with a health care provider showed effective changes in a patient's behavior and influenced their ability to better self manage their asthma. The use of the spacers was found to be successful at improving inhaler technique in six of the seven studies that used them. A spacer is a tube like device that attaches to the canister of an inhaler and allows patients to breathe in medication slowly and deeply. Without the use of a spacer an inexperienced or newly diagnosed asthmatic can incorrectly inhale medication or not at all. Spacers were believed to improve asthma functional status in three studies, due to the spacer's ability to disperse the correct amount of medication from the inhaler to the patient. The use of rescue inhalers was the fourth most used intervention with six studies. The use of corticosteroids is recommended by the most current asthma guidelines. Use of corticosteroids was recorded in only three studies.

Measurements and Follow-up

The measurement and follow-up intervention category includes how programs measured improvements and how follow-up was conducted with participants. The survey sub-category is the most frequently used tool in the measurements and follow-up category with 10 programs using surveys as evaluation and/or patient assessments. Programs used surveys to measure and determine improvements in asthma knowledge, asthma management, and quality of life (QOL). A total of seven different types of QOL surveys were reported among all 10 of studies. The most

common QOL survey was the Asthma-Specific Quality of Life Questionnaire (AQLQ) with four. Four of ten studies including, Marijanian, Wolf, Goethe, Hernandez, and Horowitz (1999), Tousman et al. (2007), Martin et al. (2009), and Smith et al. (2007) used two different quality of life surveys, while the remaining six studies used only one. Table 7 shows how often QOL surveys were used.

Table 7. Quality of Life Surveys

QOL Surveys	Number of studies
1. AQLQ	5
3. QOL	2
6. HSQ	2
4. CES-D	2
5. CQPES	1
2. HRQOL	1
3. DSS	1

Eight different surveys were used for asthma management, to evaluate participants' ability to management their asthma. Asthma management was the second most used survey sub-category with a total of seven studies using at least one survey. Unlike the QOL survey sub-category, there was not one specific asthma management survey used more than the rest. The Living with Asthma Questionnaire (LWAQ) and Lara Asthma Symptom Scale (LASS) both were used in two studies. The remaining six surveys were used in one study each. Two studies used multiple surveys to evaluate a participants' ability to manage their asthma. Olajos-Crow et al. (2005) used the Asthma Management Questionnaire (AMQ) and Perceived Control of Asthma Questionnaire (PCAQ). Smith et al. (2007) used the Medication Adherence Report Scale (MARS), Asthma Control Questionnaire (ACQ), and the Asthma Self-Efficacy Questionnaire (KASEQ). Table 8 shows how often asthma management surveys were used.

Table 8. Asthma Management Surveys

Asthma Management Survey	Total Studies Used
1. AMQ	1
3. PCAQ	1
2. LWAQ	2
3. MARS	1
4. ACQ	1
5. LASS	2
6. KASEAQ	1
7. HSAP	1

The Asthma Related Knowledge (ARK) and Asthma General Knowledge Questionnaire (AGKQ) were the only two asthma knowledge surveys used in all 10 studies. Urek et al. (2005) used the ARK. Choi and Chung (2010) used AGKQ. These two programs used a total of three surveys and were the only studies to use a survey in all three of the survey sub-categories (QOL, management, and knowledge). Smith et al. (2007) used the most surveys in their asthma program with a total of five. The majority (six) of the 10 studies used two surveys and the remaining used three surveys.

Home visits, one-on-one sessions, and telephone calls are follow-up interventions that were included in the measurements and follow-up intervention category. Home visits and telephone calls were used in three of the 15 programs reviewed. One-on-one follow up were used in two programs. Of the three interventions home visits were the most successful at improving participants' asthma. All three studies using a home visit as follow-up discuss the significant benefit of having a health care provider visit a participant's home. Galbreath et al. (2008) and Brown, Reeves, Meyerson, and Korzeniewski (2006) used a Registered Nurse to make home visits. Martin et al. (2009) used a community health worker (CHW) that was specially trained make asthma home visits. With the help of health care providers, participants are able to identify and eliminate environmental triggers that have the potential of causing exacerbations, thus improving ones asthma and increasing management skills. Costa et al.

(2008) and Olajos-Crow et al. (2205) were the only programs to use one-on-one sessions as follow-up. Both studies reported that one-on-one sessions had moderate success in improving self-management skills after an asthma education program. The role of the one-on-one sessions was to discuss medication adherence, such as the use of corticosteroids, inhaler technique, and answer participant's questions. In addition Costa et al. (2008) performed a peak flow meter level exercise, while Olajos-Crow et al. (2005) discussed asthma action management plans. Placing telephone calls as follow-up was believed to be significant in reminding the participant to pay attention to their condition, but it is not clear the ability to improve management skills.

Health Assessments and Interviews

In the health assessments and interviews category registered nurses were the most common health care professionals to work with the participants of the program. A total of four studies used registered nurses as compared to doctors, pharmacists, certified asthma educator and a trained investigator that were used in one study each. Five studies used a point system or scorecard to measure the participant's ability to manage their asthma. Participants received a scorecard that assessed different asthma management skills, such as having a current action plan. Participants were then given a number or a check mark to show their individual progress. Scorecards were also used as a summary evaluation, allowing participants and coordinators to measure improvement throughout the program in asthma management. It was also proved useful in summative evaluation that measures the overall success and benefits of a program. Communication with the participants' primary care doctor was used in two studies, both of which emphasized the importance of interaction between health programs and primary care.

Guidelines

The National Heart Lung and Blood Institute (NHLBI) and the Global Initiative for Asthma (GINA) were the two guidelines used among the studies. NHLBI is a branch of the National Institutes of Health (NIH) a United States Department of Health and Human Services. Every couple of years the National Asthma Education and Prevention Program (NAEP), a department within NHLBI, releases an Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma. Seven programs used these expert guidelines and was the most commonly used reference for program design. NHLBI asthma guidelines were first released in 1991 and have more use throughout the United States. GINA's Global Strategy for Asthma Management and Prevention, first published in 2002, was the second most commonly used guideline. It consists of evidence-based guidelines for asthma management and prevention, with citations from the scientific literature (GINA, 2011). GINA works with health care professionals and public health officials around the world to reduce asthma prevalence, morbidity and mortality (GINA, 2011). Three studies based their program design from GINA's set of asthma management guidelines. These guidelines were used by Costa et al. (2008), Urek et al. (2005), and Choi and Chung (2010). NHLBI's guidelines were first published 11 years prior to GINA's. For this reason, NHLBI is respected and used more for asthma management.

Discussion

The National Heart, Lung, and Blood Institute (NHLBI) provides global leadership for a research, training, and education program to promote the prevention and treatment of heart, lung, and blood diseases and enhance the health of all individuals (NHLBI, 2011). Clinical practice guidelines are put out by NHLBI, expert panel for the diagnosis and management of asthma. Although these guidelines are intended for use in a clinical setting, much can be learned and

taken into consideration from the guidelines when developing a community asthma program. The Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma, report four essential components of asthma care, namely: assessment and monitoring, patient education, control of factors contributing to asthma severity, and pharmacologic treatment (NHLBI, 2007). A comparison of the findings from this study will be compared with the NHLBI guidelines because it is the most commonly used reference in asthma management.

Component 1: measures of asthma assessment and monitoring showed many differences with the findings of this study, mainly due to its focus in clinical practice. It is recommend by the guidelines that if the patient is not currently taking long-term control medication, severity of the asthma be assessed during the patient's initial presentation to guide clinical decisions on the appropriate medication and other therapeutic interventions. Based on the guidelines, therapy was solely based on the clinical management through the use of medications prescribed by a physician. Assessing asthma severity had importance in community programing, but was usually determined with the use of surveys, peak flow meters, or one-on-one communication with an asthma health care provider. A test most used by the guidelines to assess the risk of future adverse events is spirometry. Instead, asthma programs in this study commonly used peak flow meters to replace spirometry because of they are inexpensive cost and the easy to use. The need for a simple, easily applied, more accurate test has prompted studies of "biomarkers," whose deviations from normal might correlate with the severity of risk (NHLBI, 2007). While many types of biomarkers were proposed by the guidelines, none of the programs reviewed in this study used or even recommended their use.

When looking at similarities, it is important to note that the NHLBI does recognize that diagnosing and prescribing therapy is only the first step. More should be done in reducing the

symptoms, functional limitations, impairment in quality of life, and risk of adverse events that are associated with this disease (NHLBI, 2007). In component 1, the six areas listed below are recommended for asthma management based on the opinion of the NHBLI Expert Panel and review of scientific literature.

- Monitoring signs and symptoms of asthma
- Monitoring pulmonary function
    - Spirometry
    - Peak flow monitoring
- Monitoring quality of life
- Monitoring history of asthma exacerbations
- Monitoring pharmacotherapy for adherence and for potential side effects
- Monitoring patient-provider communication and patient satisfaction
- Monitoring asthma control with minimally invasive markers and pharmacogenetics (requires further evaluation)

While expert panels of this report state these markers require further evaluation before they can be recommended widely for routine asthma care, it is worth considering due to the supporting results of this literature analysis. Based on the results of this study and supporting evidence found in component 1, all recommendations except for monitoring asthma control with minimally invasive markers and pharmacohenetics, should be considered evidence-based practices in community asthma program.

Component 2: education for a partnership in asthma care is specifically geared toward integrating asthma self-management education into all aspects of asthma care. The importance of linking asthma management reinforcements through multiple health care professionals was expressed in the literature and attempted by different means in a number of the studies reviewed. NHLBI guidelines suggest repetition and reinforcement by involving all members of the clinical health care team. Smith et al. (2007) focused on pharmacy-based education directed toward understanding medications, teaching inhaler techniques, and self-monitoring skills and was successful at improving self-management skills and asthma outcomes. Other studies like Martin

et al. (2009) tried another approach of providing education at all points of care by visiting participant's homes, which was also shown to be beneficial by the NHLBI. According to the guidelines, the emerging evidence for computer and Internet programs to be incorporated into asthma care has potential for increasing asthma education. Surprisingly, the use of computers or Internet was not documented in any of the studies as an educational intervention tool. This was surprising given that 12 of the studies in this analysis were published between the years 2000 to 2010.

Having patients work on written asthma action plans was an important similarity between this study and the guidelines. Overall findings of this study as well as the guidelines suggest incorporating daily management aspects of asthma and how to recognize and handle worsening asthma or exacerbations. NHLBI and this study suggest action plans particularly for patients who have moderate or severe persistent asthma, a history of severe exacerbations, or poorly controlled asthma. However, it is important that every asthmatic have an action plan, regardless of person's severity or ability to control asthma in a community asthma program. Working in conjunction with a health care provider to develop a patient's action plan was also significant in both NHLBI and this study. Research shows that providing patients with asthma action plans increases self-management education, training, and self-monitoring (either symptoms or peak flow meter). Due to this support, creating an asthma action plans with the assistance and input of a health care provider should be considered an evidence-based practice for community asthma programs.

Component 3: control of environmental factors and comorbid conditions that affect asthma discusses the role of environment in asthma management. There were found to be many similarities between NHLBI and this study within this component. Much of what is discussed

relates to the asthma education intervention category. The expert panel recommends that patients who have asthma at any level of severity should be taught about the exposures to inhalant allergens, particularly indoor inhalant allergens, and their potential effect on the patient's asthma (NHLBI, 2007). In the NHLBI guidelines, avoiding triggers, such as allergens and cigarette smoke are key points to controlling ones environment and was found to be equally important in this study. With 12 of the 15 studies educating participants on either trigger avoidance or environmental symptom control and with the NHLBI support, these interventions should be considered evidence-based practice.

The expert panel recommends that patients should reduce exposure, as much as possible to allergens to which the patient is sensitized and exposed (NHLBI, 2007). They also recommend that the first and most important step in controlling allergen-induced asthma is to advise patients to reduce exposure to relevant indoor and outdoor allergens to which the patient is sensitive (NHLBI, 2007). This includes allergens like dust mites, cockroaches, molds, animal dander. Many adults that are newly diagnosed, live in inner cities, or are low-poverty do not understand the role ones home environment can have on controlling asthma. This was the main reason why three of the 15 studies conducted home visits. Home visits were conducted by Martin et al. (2009), Brown et al. (2006), and Galbreath et al. (2008), all of which educated one-on-one or in a group session on reducing allergens weeks before visiting a participants home. Each of these programs demonstrated success in reducing environmental allergens as quickly as after their first home visit from a health care provider. It was not surprising to learn that NHLBI acknowledges that allergen-control education interventions provided in the home setting have been proven effective for reducing exposures. However they recommend that further research be done to evaluate widespread implementations.

A patient's inhalant sensitivity is determined due to the influence allergens can have on asthma morbidity and asthma management. Determining the patient's exposure to allergens through assessment questions was also found to be similarity between NHLBI and this study. However, NHLBI first recommends review of patient's medical history and use of skin testing to determine the presence of specific IgE antibodies to indoor allergens. Community programs generally do not have access or funding for skin tests and medical history is usually based from the patient's memory. If medical history or skin test is not available, NHLBI suggest asking questions related to inhalant allergens. These include allergens are associated with workplace exposures, tobacco smoke, and indoor/outdoor irritants. Questions about medication sensitivities, Rhinitis, and Gastroesophageal Reflux Disease (GERD) are also topics that should be addressed. Surveys that were used in this study were found to ask questions related to the same topics. Surveys that showed the most similarities at assessing for the patient's allergens included, Asthma Management Questionnaire (AMQ), Living with Asthma Questionnaire (LWAQ), and Health Survey of Asthma Patients (HSAP). Urek et al. (2005) and Choi and Chung (2010) used the LWAQ in their programs and was the most commonly used survey of the three listed above. The LWAQ had the most similarities to the types of questions the NHLBI recommended versus the AMQ and the HSAP. Even with just two surveys using the LWAQ in this study, it should still be considered an evidence-based practice for assessing a patient's exposure to allergens.

The importance of knowing ones occupational exposures was found to be very important by the NHLBI. The expert panel recommends that health care providers ask patients who are employed and have asthma about possible occupational exposures, particularly those who have new-onset disease (NHLBI, 2007). The relevance of occupational exposures was a large

difference, in which none of the studies analyzed in this study discussed the importance. Occupational exposures could have been discussed while educating on trigger avoidance, but without studies being specific it is assumed that they did not. Another difference between NHLBI and this study is the ability to evaluate the patient for presence of a chronic comorbid conditions, such Allergic Bronchopulmonary Aspergillosis or GERD. Very few doctors are usually involved with community programs and the ability to diagnose diseases is just not possible. Registered nurses are able to give some input about symptoms, but the patient should ultimately be referred to a doctor. Community programs usually refer patients to a doctor.

Component 4: medications, is crucial to effectively manage ones asthma. Pharmacologic therapy is used to prevent and control asthma symptoms, improve quality of life, reduce the frequency and severity of asthma exacerbations, and reverse airflow obstruction (NHLBI, 2007). Results from this study indicate just how important medication is. All 15 studies indicated that education or use of an asthma instrument was done to teach their participants about medication. Asthma medications are categorized into two classes: long-term control medications taken daily on a long-term basis to achieve and maintain control of persistent asthma and quick-relief medications taken to provide prompt reversal of acute airflow obstruction and relief of accompanying bronchoconstriction (NHLBI, 2007). The use of both long-term and short-term medications was also supported in this study. Six studies identified that they educated with a short-term rescue inhaler, but only three discussed the use of corticosteroids as an asthma instrument used in their program. Olajos-Crow et al. (2005), Costa et al. (2008), and Urek et al. (2005) were the only programs to discuss the use of corticosteroids, even though many of the remaining studies recommended the use of long-term and short-term medications. NHLBI recommends both medication treatments for patients that have persistent

asthma. With that said the severity of the participants in these programs could have played a role in the under use of corticosteroids. Very few studies had participants that were considered to have high persistent severity. If the studies did have high severity cases, the number was usually low.

To reduce the potential for adverse effects from medication, NHLBI recommends the use of spacers, which refers to a simple open tube that attaches to an inhaler, and metered dose inhalers (MDIs), an inhaler that only allows a certain dose to be administered at one time. Spacers are intended to retain large particles emitted from the MDI. There is no data on the use of spacers attached to low-particle MDIs and until further research is conducted, spacers should only be used for larger particle MDIs. Asthma medications can be confusing to many patients that do not get the proper education or instruction for technique. In this study, spacers and MDIs were found to be a successful instrument at increasing inhaler technique and self-efficacy. Many researchers believe that if one can increase self-efficacy, then the ability to self manage a disease will improve. This could then explain the number of quality of life and self-efficacy surveys that were administered in eight of the programs in this study. The only study that specifically addresses self-efficacy is the Asthma Self-Efficacy Questionnaire (KASEAQ). If the KASEAQ were not available or too costly the Asthma-Specific Quality of Life Questionnaire (AQLQ) would be a good alternative due to its commonality and wide use in asthma management programs. NHLBI did not discuss the use of any specific asthma related surveys, unlike the programs in this study. With the support of NHLBI, spacers with use of an MDI should be considered an evidence-based practice for asthma community programs. Self-efficacy surveys should continue to be used to determine participant's needs. More research needs to be

conducted before we can say improving self-efficacy, will increase ones ability to management their asthma.

Recommendations

Based on the comparison of the NHLBI guidelines and the findings in this study, recommendations for future community asthma programs were developed. Assessing the asthma severity should be the first step in any community asthma management program. Assessing severity in community programs should be done through the use of surveys, such as the Health Status Questionnaire (HSQ) or peak flow meters because they are effective and inexpensive. Programs that have higher budgets should consider using spirometry in combination with peak flow meters to measure severity. During the assessment phase, the influence of allergens should also be determined with the use of the Living with Asthma Questionnaire (LWAQ) or a modified and shorten version of the LWAQ. Determining allergen influence of participants will be useful when educating on environmental triggers. After assessing for allergen influence and educating on how to avoid triggers like cigarette smoke, it is recommended that at least one home visit be made. Ideally, at least two home visits should be made. The first home visit should be to conduct an initial assessment and the second should follow-up on previous suggestions and praise improvements. While home visits are time consuming and can be expensive, it is recommended to conduct the home visit after educating on environmental triggers and allergens or at the end of the program. It is important to allow the participant time to make his or her own environmental changes before a health care provider makes the home visit. This intervention was shown to increase self-efficacy and knowledge of preventing asthma exacerbations.

While trying to link all of participant's health care providers can be a daunting task for a community program, it is recommended communication between the two be conducted.

Increasing the communication between participant's health care providers allows for repetition and reinforcement of asthma management practices. It was also found that many patients that participate in community asthma programs do not have primary health care providers. It should also be the job of the community program to link the participant with the appropriate primary care for future needs. Once communication is established, it is recommended that action plans be conducted within the program and reported to the participant's primary health care provider. It is important to do the action plan in conjunction with the participant to increase self-efficacy and knowledge of asthma management skills. It is recommended to conduct an action plan for every asthma participant, but especially for participants with severe, persistent, or uncontrolled asthma.

In asthma management it is important for the participant and community program to monitor management skills for improvements. It is recommend that along with monitoring severity (signs and symptoms) of asthma and peak flow or spirometry, the following should also be monitored in a community asthma program:

- Monitoring quality of life
- Monitoring history of asthma exacerbations
- Monitoring pharmacotherapy for adherence and for potential side effects
- Monitoring patient-provider communication and patient satisfaction

Monitoring these asthma components gives the community program a summative evaluation method and shows the participants their progress and areas of improvement. Finally, what is likely the most important recommendation involves the use of asthma medication. The use of medication must be incorporated into a community asthma program to effectively manage asthma. Many community programs do not have the budget to give medications to their participants, but it is high recommended that they incorporate medication education into their program. Education on medication should involve discussing the difference between long-term

corticosteroids and rescue inhalers, technique of inhaler use, and the use of spacers. Medication education should be discussed early on into the community program to allow for medication questions during future sessions.

Conclusion

In this study the best practices or evidence-based interventions were identified for future the development in adult community asthma programs. This included community based asthma management programs that served adults 18 years or older. Selected programs were community based or inhabited similar interventions and practices to community based programming. Using Brownson's et al. (2009) typology for classifying interventions, as the selection process was useful in identifying which studies were evidence-based, effective, promising, and emerging. The selection process of this study showed how vital it is for public health professionals to be able to assess and determine what evidence-based is. Using criteria and relying on multiple sources should assist public health professionals in determining evidence-based practices. This study showed the process of that determination and will prove helpful in future public health research.

This study determined which programs used the best and most effective asthma interventions and allowed for recommendations to be made for future community asthma programs. Program planning should be judged on the basis of whether it helps an organization to achieve the best possible results in changing environment (Turnock, 2004). This involves a process that includes research of the problem and need with review of the most current literature. All too often, little thought is given to the planning process due to time constraints, budget, or funders. This study will be useful in assisting public health organizations that do not have the

time or budget to research and decipher on their own which interventions are considered evidence-based in community asthma programming.

Limitations

A limitation in this study included that lack of community asthma programs in the literature. The availability to information and data from community asthma programs was limited and at times difficult to identify. While a majority of the programs included in this study were community programs, a few were hospital or insurance based with similar interventions to community asthma programs. With all programs not being community based, some recommendations may be skewed or inaccurate for future community asthma programming. New studies and data are published every day making it impossible to retrieve all of the most current information. This was a limitation to this study because publishing studies can be a timely process in which the data has potential for being dated by publishing date. A final limitation to this study involves the use of guidelines. Many interventions may be included in guidelines that may not appear in studies or vice versa. Studies tend to include emerging or promising interventions while guidelines leave out these interventions and focus on the most common or most effective at a given time. This gives little attention to the emerging or promising interventions that have potential in being evidence-based in the future. It may be difficult to prevention these limitations, but it is important to acknowledge the effects they may have on the results of this study.

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Appendix A – List of Public Health Competencies Met

Specific Competencies
Domain #1: Analytic Assessment Skill
Defines a problems
Determines appropriate uses and limitations of both quantitative and qualitative data
Selects and defines variables relevant to defined public health problems
Identifies relevant and appropriate data and information sources
Evaluates the integrity and comparability of data and identifies gaps in data sources
Makes relevant inferences from quantitative and qualitative data
Obtains and interprets information regarding risks and benefits to the community
Applies data collection processes, information technology applications, and computer systems storage/retrieval strategies
Recognizes how the data illuminates ethical, political, scientific, economic, and overall public health issues
Domain #2: Policy Development/Program Planning Skills
Collects, summarizes, and interprets information relevant to an issue
Utilizes current techniques in decision analysis and health planning
Decides on the appropriate course of action
Develops a plan to implement policy, including goals, outcome and process objectives, and implementation steps
Domain #3: Communication Skills
Communicates effectively both in writing and orally, or in other ways
Effectively presents accurate demographic, statistical, programmatic, and scientific information for professional and lay audiences
Domain #4: Cultural Competency Skills
Identifies the role of cultural, social, and behavioral factors in determining the delivery of public health services
Domain #5: Community Dimensions of Practice Skills
Identifies how public and private organizations operate within a community
Identifies community assets and available resources
Domain #6: Basic Public Health Sciences Skills
Defines, assesses, and understands the health status of populations, determinants of health and illness, factors contributing to health promotion and disease prevention, and factors influencing the use of health services
Identifies and applies basic research methods used in public health
Applies the basic public health sciences including behavioral and social sciences, biostatistics, epidemiology, environmental public health, and prevention of chronic and infectious diseases and injuries
Identifies and retrieves current relevant scientific evidence
Identifies the limitations of research and the importance of observations and interrelationships
Attitudes
Develops a lifelong commitment to rigorous critical thinking
Domain #7: Financial Planning and Management Skills
Manages information systems for collection, retrieval, and use of data for decision-making
Domain #8: Leadership and Systems Thinking Skills
Identifies internal and external issues that may impact delivery of essential public health services (i.e. strategic planning)