CAPQuaM Asthma Measures #1-2 Appendix

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Appendix A

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Appendix B

Literature Review- Phase I and Phase II

CAPQuaM
Asthma Construct

Literature Review

April 13, 2012

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The Joint Commission

Executive Summary

Asthma is a chronic inflammatory disease that affects millions of people in the United States. It is one of the most chronic diseases of childhood. Health care advances have led to an increased understanding of asthma and its mechanisms as well as improved treatment approaches. Although there have been gains in asthma management over the past two decades, the burden of avoidable hospitalizations remains. The provision of quality care for all those with asthma remains a challenge.

The asthma population is defined in current measures through the use of an asthma diagnosis or ICD-9 code. In studies that aimed to efficiently diagnose asthma, a variety of diagnostic tests were reviewed. The following diagnostic tests were analyzed for validity, reliability and practicality. It was determined that the use of a bronchial provocation test with exercise, was equally valid and practical when compared to the use of a sputum analysis. The use of a pulmonary function test (PFT's) was also determined to be valid when compared to the use of an asthma predictive index (API) test. Both were found to be highly practical.

Barriers to receiving an asthma diagnosis were evaluated in this literature review as well. There is difficulty in diagnosing very young children under five years old, those who are uncooperative, or exhibit vague symptoms. There was a great deal of variety in acceptable diagnostic testing, however, there is also an increase in research interest regarding the accuracy and feasibility for asthma diagnostic testing in preschool age and school age children. Comorbidities that are common to this pediatric asthmatic population were reviewed as well.

It is recognized that asthma care is rendered at multiple points of care; primary care settings, Emergency Departments (EDs), and inpatient hospitalizations. It is further acknowledged that there is variation in the management of acute pediatric asthma. The National Heart, Lung, and Blood Institute (NHLBI) has provided and updated guidelines for the Diagnosis and Management of Asthma since 1992. Management of the patient with asthma is centered on four aspects of care: 1. Assessment and Monitoring, 2. Education, 3. Control Environmental Factors and Comorbid Conditions, and 4. Medications.

The literature review noted that physicians do not consistently utilize practice guidelines for asthma. Limited knowledge of physicians impacts their ability to make an appropriate diagnosis and facilitate appropriate treatment. The literature suggests that a multidisciplinary approach both in the ED and outpatient setting promote the greatest success in asthma management.

Patient and families are also limited in their knowledge base of appropriate home management. Parents often minimize the severity of symptoms manifested by their children at home. This causes delay in administration of appropriate medication resulting in acute exacerbations and subsequent trips to the ED.

Although it is agreed that asthma education is useful, evaluating the effects of this intervention with evidence-based medicine techniques is difficult. There are a number of variables that influence the success of an education plan. It does appear that the best results are realized through a partnership between the health care team, the child with asthma and his or her parents.

With respect to evaluating the adequacy of the primary care physician (PCP) practice to provide appropriate treatment for children with asthma, it is important to recognize that providers are increasingly challenged by financial and time constraints, making comprehensive care more

difficult to deliver. A number of initiatives are underway to improve asthma care delivery in the primary care office, but it is equally important to note the role of patients/families in asthma care.

Physician knowledge can be enhanced through education. Practice design can be updated to encompass a more multidisciplinary approach. Patient/family education is essential but it is also crucial to maintain open lines of communication between the all levels of care providers, the PCP, and patients and their families.

Transition of care is reliant upon communication of providers when children transition from one level of care to the next. The literature reviewed examined follow up visits for pediatric asthmatic children after an emergency room visit. Noncompliance for follow up is best avoided when health care staff can identify those at risk for lacking the knowledge of resources, or the ability to obtain resources for follow up care. It was determined that healthcare personal had better results in adherence to follow up appointments when the children were discharged from the emergency room with the appointment already made. Education was found to correlate with utilization of healthcare resources. When staff spent time educating patients and caretakers, patients were more likely to utilize those sources. Consequently, utilization of health care resources was found to directly correlate with improved outcomes such as lung function and decreased school absenteeism; however, education of children who had received emergency care did not reduce the need for subsequent emergency visits.

Children from low income families and children who were seen in an emergency room that provides substandard care had an increase in emergency visits and inpatient hospitalization as well. Consistent use of inhaled corticosteroid therapy demonstrated a reduction in hospital admission rates in children presenting to the emergency room in asthmatic exacerbation. The use of National and International guidelines for the care of asthmatic children was found to be inconsistently followed. Communication as well as coordination of care favorably affects the discharged asthmatic patient.

The lack of a primary care provider, or ambulatory care, as well as a lack of resources did lead to a greater use of the emergency department in this patient population. The lack of a primary care provider, previous to an emergency room visit, only contributed slightly to asthma morbidity in the population reviewed.

The lack of resources as indicated above is evident in discriminatory populations. The literature indicates a predictable difference in the processes of caring for children of minority populations, thus representing an inequitable structure of healthcare. The availability of Emergency Department (ED) care and the frequency of visits are relative to the adequacy of outpatient care, ambulatory care, disease severity, and hospital admission practices. The literature review identified that weak processes structured around the education of families, specifically to correct identification of signs and symptoms of asthma exacerbations, increases the unavoidable use of emergency services in minority populations.

Predictable differences and imbalanced resources affect the quality of care in the ED pediatric asthmatic population. Optimal monitoring of outpatient care in the management of asthma could reduce costly acute care services. Children with uncontrolled asthma from minority groups have poor asthma outcomes, and more *asthma related visits* to the Emergency Room.

Debate remains as to how racial and socioeconomic factors influence both asthma severity and rates of recurrent emergency room visits. Populations examined for healthcare disparities revealed surprising differences in identified triggers, in perception of care, and those barriers that decrease adherence to outpatient care.

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A. Summary

B. Annotated Bibliography

I. Methodology

The work began with a review of the Asthma Construct Table. The search process was guided by six concepts within the construct:
1. Need to Specify Population for Measure
2. Adequacy of Management of Asthma
3. Adequacy of PCP Practice Site to Handle Acute Exacerbations
4. The Connectedness of Care in the Primary Care and ED Setting
5. Equity is a Value in Asthma Care

The search was conducted from March 2012 – April 2012. 12, 800 citations retrieved, 157 sources used.

PubMed Search
Limitations to this search included only those articles in English pertaining to ages 0-18 years old.

The following strategies were used:

<u>Search 1</u>
Search terms:
"Physician-Patient Relations" [Mesh]) AND "Asthma" [Majr] (relationship [ti] or role [ti])
"Physician, Primary Care" [Mesh] AND asthma [Majr] AND (relationship or role [ti])
"Disease Management" [majr] AND asthma [majr]
"Asthma/diet therapy" [Majr] OR "Asthma/drug therapy" [Majr] OR "Athsma/therapy" [majr]
"Asthma/diagnosis" [Majr]
("Emergency Service, Hospital" [Majr] OR "ED visit") AND Asthma [majr]
"Self care" [majr] AND asthma [majr]
"Patient education as topic" [majr] AND asthma [majr]
"Reminder Systems" [majr] AND asthma [majr]
("Social Media" [mesh] OR internet [mesh] or twitter) AND asthma [majr]
("Healthcare disparities"[mesh] or "minority health" [mesh]) AND asthma [majr]

<u>Search 2</u>
A second limited search as done on the following free text terms:
"African American" AND asthma
"Black" AND asthma
"Latino" AND asthma
"Asian" AND asthma
"Race" AND Asthma
No sources were retrieved from this additional search. The articles used in this review were selected reflect the nature of the above search terms, as the same key words were present in the sources. It is assumed an exhaustive search would have resulted in the same article selection.

Web Search
An internet search was performed. The following terms were searched:
"Capacity of PCPs to manage children asthma"
"Asthma office visits"
"Access to asthma specialist"
"Wait time to see asthma physician"

II. Need to Sufficiently Specify Population for Measure

Summary

When evaluating asthma care for children, the initial patient population is very diverse. Current measure populations consist of children with a confirmed asthma diagnoses or children with an active *International Classification of Diseases, Clinical Modification* (ICD-9 CM) codes for asthma. In addition, children with lower respiratory tract symptoms, including bronchial obstruction, and children with increased use of antibiotics are consistently represented in asthma studies.

Studies of pediatric patients who did not have an active diagnosis of asthma but reported symptoms found that children with persistent cough and wheeze, chronic cough, breathlessness, wheeze and breathlessness, or speech restricted breathlessness were assessed for asthma. Children with recurrent wheeze, especially after age six, those with allergic rhinitis, and those who reported a cough at night were also assessed for the diagnoses of asthma.

Children under age five are considered potential asthmatics if they report the following: frequent wheeze, affected sleep, and more than three episodes that lasted beyond one day in the past year. Non cooperative children with persistent allergy symptoms and those with a recurrent cough for greater than two outpatient visits were also included. Patients with shortness of breath and those who reported wheezing during at least one visit in the last twelve months were also considered as potential asthma patients.

This literature review defined asthma as airway hyperresponsiveness and bronchial obstruction with reversibility when short acting beta agonist (SABA) is administered. Measurements of FEV_1, before and after SABA therapy, are indicative of asthma, as evidence by an improvement of $FEV_1 > 200$, and or 10% reversibility from baseline. A positive inflammation of eosinophilia in sputum samples is also used for diagnostic purposes. The literature reported some practioners using physical assessment criteria to diagnose asthma, including presence of atopy, allergy triggers, auscultation of wheeze during five breaths lasting a 45 second period, and reversibility of inflammation and bronco motor tone with inhaled cortico steroids therapy, assessed by computer imaging. This literature review concluded that asthma cannot be defined in premature, very young children, those with post bronchiolitis, viral associated wheezes, obliterated bronchiolitis, or non-atopy associated with a later onset of wheeze.

The impact of including various types of data on the sensitivity and specificity of an asthma diagnostic tool is included the following tests:

- Mannitol used for bronchial provocation had sensitivity and specificity of 56% and 73% and this was no different to methacholine 51% and 75%.
- The stringent Asthma Predictive Index (API) has a specificity of 96% to 97% and a sensitivity of 15% to 28%.
- The loose API has a sensitivity of 80% to 82% and a specificity of 40% to 57%.
- The negative predictive value for both the stringent and loose APIs is high at 87% to 94%

The literature review identified diagnostic testing for asthmatic children using: valid, valid and practical, not valid, and not practical testing below.

Valid

- Bronchial Provocation with methacholine
- Induced sputum analysis
- Exhaled nitric oxide as a biomarker of airway inflammation in Exhaled Breath condensate
- Exhaled Breath Condensate biomarker of proteome and to reveal the disease specific proteolytic peptide or protein pattern.
- Impulse oscillation and forced oscillation
- Trial with steroid treatment
- Biomarker of Specific Immunoglobulin E (IgE)
- Bronchial biopsies
- Volatile Organic Compounds in exhaled breath condensate
- Serum analysis of activated eosinophil granule proteins
- Serum analysis of Eosinophil Degranulation
- Genetic chromosome analysis of *ADAM33* and *ORMDL3*
- Chinese Childhood Asthma Control Test
- Invitro allergen-specific immunoglobulin E (IgE) testing
- Exhaled Breath Condensate pH changes
- Sputum analysis of Creola Bodies

Valid and Practical

- Bronchial provocation with exercise
- Induced sputum analysis
- Four Phenotypes
- Symptom analysis
- Asthma Predictive Index
- Incentive Spirometery
- Brief Respiratory Questionnaire
- Breathmobile Case Identification Survey
- Pulmonary Function Testing
- ISAAC questionnaire
- Airway Compliance and Asthma Development Predictive Rule (ARCADE)

Not valid

- PEF peak expiratory function
- FEV Fixed expiratory volume
- Specific Airway resistance
- Whole Body plethysmography
- Asthma Predictive Index
- Visual Analogue scale of Symptoms
- Acoustic recordings for breath analysis

Not Practical due to invasiveness and cost effectiveness.

- Biomarkers,
- Tissue sampling is discouraged due to invasiveness and cost effectiveness

- Use of diagnostic medications to confirm asthma diagnoses

There are differences in how adults and children are diagnosed with asthma. This literature specified the following differences below:

ADULT

- Adults have more subjective material to describe symptoms
- Adults can accurately perform Incentive Spirometery
- An increase of 10% of the predicted FEV_1 after inhalation of a SABA may have higher likelihood of separating patients who have asthma from those who have chronic obstructive pulmonary disease (COPD)

CHILD

- There is a high incidence of episodic wheeze in respiratory illness
- Ordinary wheeze can be same as asthmatic wheeze
- Small airway can be irresponsive to bronchodilator therapy
- Viral Induced airway reactivity common in young children
- PFT's like Spirometery, FEV, and FVC: can reveal poor lung function in patient who are asymptomatic, but could benefit from intervention
- These require patient performance, following of commands, and physiological capability of performing the required breathing maneuvers
- It is assumed less than 5 years old are not able to reliably perform the test

The literature search identified a great deal of co morbid conditions that are not defined in the asthmatic population. It was suggested that these conditions are ruled out prior to the asthmatic diagnoses. There was no noted rationale provided for the above exclusion.

Co morbidity

- Bronchitis
- Viral lower respiratory infection
- Recurrent upper respiratory tract infection
- Broncho pulmonary dysplasia
- Cystic Fibrosis
- Congestive Heart Failure
- Bronciolitis
- Allergy rhinitis
- Airway obstruction large
  - Foreign body
  - Mass or tumor
  - Vocal cord dysfunction
- Airway obstruction small
  - Bronchiolitis
  - Cystic fibrosis
  - Bronco pulmonary dysplasia
  - Heart disease
  - Aspiration
- Vocal Cord Dysfunction

The following issues were identified as barriers to diagnoses of asthma for children up to age twenty one. Literature reveals a barrier to diagnosing asthma in children younger than five. Those children, who are unable or unwilling to cooperate during a test, especially when invasive testing is required, are unreliable in and unrepeatable as well. Symptom experience, frequency and symptom report can be a barrier as well. The literature indicates that this becomes consistent as children age. These issues differ and change as children mature and transcend differing developmental stages. Debate continues in this literature search regarding reactive airway disease, and its association with asthma. Management of both asthma and reactive airway disease have similar reported outcomes with use of bronchodilators and corticosteroids. There was a noted analysis of additional conditions of allergy sensitization, histamine responsiveness, and atopy and peak flow variability that were found to be commonly managed as the asthmatic plan of care when the newly diagnosed asthmatic child seeks treatment.

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This study reviewed bronchial provocation with methacholine or exercise.
Exercise or mannitol was used to identify a bronchial hyper responsiveness.
The study reviewed a mixed population of adults and kids.

Mannitol and methacholine were therapeutically equivalent to identify exercise induced bronchial constriction as a manifestation of bronchial hyper responsiveness.

Subjects included known asthmatics and those who had a fall in FEV_1.

The specificity and sensitivity of mannitol was found to identify a clinical diagnosis of asthma. This was true in 59.8% of the non asthma populations, and 95.2% of the asthma populations.

In this study the subjects presented with symptoms, but without a definite diagnosis of asthma. Testing concluded that mannitol had sensitivity and specificity of 56% and 73% and this was no different to methacholine 51% and 75%.

Araujo L, Moreira A, Palmares C, Beltrao M, Fonseca J, Delgado L. (2011). Induced sputum in children: success determinants, safety, and cell profiles. *Journal of Investigational Allergology and Clinical Immunology, 21 (3),* 216-221.

Study conducted to evaluate the value of induced sputum analysis in children with asthma. The identification of sputum eosinophilia currently has clinical value in predicting a favorable response to corticosteroids and can therefore guide treatment. It was concluded that sputum induction was safe, noninvasive, and feasible, and that it allowed the direct assessment of airway inflammation in most children.

Aydin A, Taira B, Singer AJ.(2008). Measurement of exhaled Nitric Oxide in the emergency department in patients with asthma. *Emergency Medicine Clinics of North America, 26(4); p.*899-904.

Acute asthma exacerbations are life threatening events that warrant prompt diagnosis and treatment in the emergency department. A great deal of research has been conducted on the utility and usefulness of exhaled nitric oxide (NO) as a biomarker of airway inflammation and its role in the diagnosis of acute asthma exacerbations. This article reviews evidence for the use of exhaled NO in acute asthma exacerbations. Although further study is indicated, measuring exhaled NO in the pediatric population can help emergency medicine physicians quickly diagnose asthma in children who are unable to communicate their symptoms fully.

Baena-Cagnani, C.E., and Badellino, H.A. (2010). Diagnoses of Allergy and Asthma in Childhood. *Current Allergy Asthma Report, 11*, 71-77.

The aim of the present review is to analyze the current knowledge regarding making an early and accurate asthma diagnoses, and therefore deciding on the correct treatment to gain control over asthma symptoms and minimize health risks.

Definition of asthma: a chronic inflammatory disorder of the airways in which many cellular elements play a role.

Airway hyper responsiveness (AHR) is leading to wheezing episodes in which breathlessness, chest tightness and coughing occurs most at night and early morning.

This study identified an increase in progress in developing national and international evidence bases asthma guidelines. These have helped to improve asthma management and helped to identify and treat new asthma, but may have led to over diagnoses of asthma and may contribute to the increased proportion of accurately diagnosed asthma cases.

Overtreatment or inappropriate treatment can lead to unintended consequences when using treatment modalities to confirm diagnoses, as well as a risk of side effects without pharmacological benefit.
Although many individuals later diagnosed with asthma exhibit their first symptoms during the preschool period, diagnosing asthma in preschool children is difficult, resulting in under treatment of asthmatic children and overtreatment of transient wheezers.

Wheeze is defined as a continuous high-pitched sound with musical quality emitting from the chest during expiration.

One of the challenges of asthma diagnosis in preschool children is the absence of a gold standard diagnostic test.

<u>Four Phenotypes are found in children's asthma:</u>

1. Prolonged early wheeze (6-54 months) - no Atopy, and increase AHR at 8 years
2. Intermediate onset wheezes (18-42 months) strong association with Atopy, and decreased AHR
3. Episodic (viral wheeze)-associated with atopic markers, prematurity and tobacco exposure

4. Multiple trigger wheeze – viral, tobacco and allergy triggers

A discussion of this category is to be used "as symptoms needed" to diagnose asthma

- Allergic wheeze
- Non allergic wheeze
- Non allergic wheeze due to increased immune response to viral infection.
- Overweight/obsess girls with early menarche – hypothesize that this is from origin of alteration in the regulation of the bronchial tone associated with hormonal changes.

API- Asthma Predictive Index

- Is used to identify children at first 3 years of life, and can assist with identifying those with a continued wheezing at school entry,
- Requires recurrent episodes of wheeze during previous years, in addition to one of two major criteria
- Physician diagnosed eczema
- Parental asthma
- Two of three minor criteria
    - Physician diagnose allergic rhinitis
    - Wheeze without colds
    - Peripheral eosinophilia

Risk Factors

- Family history
- Recurrent chest infection in infancy
- Absence of nasal symptoms at age 2
- Atopic sensitization at age 4

Prevention and incidence of asthma and mite allergy (PIAMA)

This is a birth cohort study that found predictors of asthma as being: Male sex, post term delivery, parental education and inhaled medication, wheezing frequency and wheeze/Dyspnea, apart from colds, respiratory infection and eczema are independent factors to predict subsequent asthma.

Matriciadiea et al suggested: the great heterogeneity of mechanism and risk factors for wheezing disorder, multiple algorithms and are likely necessary to predict with enough confidence the persistence of wheezing in children with early wheezing.

Also consider diagnostic tools to identify the volatile organic compounds in exhaled breath to distinguish between asthma and transient wheezing.

Currently, the gold standard to measure airway inflammation is bronchoscopy with biopsy and/or bronchoalveolar lavage. However, this is far too invasive for routine use in children.

For instance, the nonvolatile compounds in exhaled breath condensate (EBC) and volatile compounds such as nitric oxide (NO) and carbon monoxide have been used to assess respiratory diseases.

Fractional exhaled NO (FENO) can be considered a noninvasive marker of eosinophilic inflammation because FENO is elevated in children with asthma but is rarely present in nonasthmatic patients.

Besides gases in exhaled breath, nonvolatile compounds in EBC can be measured in children. In EBC, inflammatory markers, such as cytokines, chemokines, and adhesion molecules, can be measured. Increased concentrations of various markers in EBC were found in patients with asthma.

Techniques to evaluate airway resistance, such as the interrupter technique (MicroRint; CareFusion 232 Ltd., Kent, United Kingdom), impulse oscillation, and forced oscillation are increasingly applied in young children. The measurements are possible in children 1 to 2 years of age and older. A useful method to confirm the diagnosis of asthma in children 5 years of age and younger is a trial of treatment with short-acting bronchodilators and inhaled glucocorticosteroids.

In children with an intermediate probability of asthma who can perform spirometery and have no evidence of airway obstruction, consider testing for atopic status, bronchodilator reversibility, and (if
possible) AHR measurement using methacholine or exercise.

Berg, J., Brecht, M.L., Morphew, T., Tichacek, M.J., Chowdhury, Y., and Galant, S. (2009). Identifying preschool children with asthma in Orange County. *Journal of Asthma, 46*, 460-464.

An asthma diagnosis relies on mainly verbalization of symptoms, on following instructions for spirometery, and/or on response pharmacological asthma treatrnent. These are challenging in very young children and as well in English as a second language. Preschool asthma is greatly under diagnosed due to this problem.

This study seeks to modify a (BRQ) assessment to validate case detection survey in a Head Start program, and create a Breathmobile Case Identification Survey (BCIS)

Age 2-5 tested, 56% male, most Medi Cal insurance. Results concluded to identify 15 of the 52 as potential for asthma, the follow up was MD evaluation who noted 20/52. Three children were previously diagnosed.

This study focused on validation of the breath mobile Case Identification Survey (BCIS). Fifty two children were chosen to participate; testing conducted with a seven question survey.

Thirteen children were identified as having asthma from the survey; of the entire population 20 children were already diagnosed as asthmatic from a specialist.

Bianchi, M., Clavenna, A., Marco, S., and Bonati, M. (2011). Asthma diagnosis vs. analysis of anti-asthmatic prescriptions to identify asthma in children. *European Journal of Clinical Pharmacology, 67,* 967-968.

Although there are standard questionnaires, several studies have criticized the use of self reported asthma as an inaccurate measure of asthma prevalence. Several of these countries have health care databases on prescriptions and strategies for estimating the prevalence of asthma. Based on the analysis, anti asthmatic drug prescriptions were developed. An alternate method of assessing asthma prevalence in a population was examined. Medications

analyzed were use of SABA, non- SABA, or oral formulation of steroids for potential asthmatics.

This study did not find this to be a reliable method. Limitations differ from different countries, such as Italy has a National Health System so lower income children drug reimbursement was considered, but not children who were treated by private doctors. This study did support the use of examining the use of International guidelines and asthma care in children.

Bloemen, K., VanDen Heuvel, R., Govarts, E., Hooyberghs, Nelen, V., Witters E., Desager, K, and Schoeters, G. (2010). A new approach to study exhaled proteins as potential biomarkers for asthma. *Clinical Experimental Allergy, 41,* 346-356.

This study aims to analyze exhaled breath condensate in search for potential biomarkers for asthma. This was done to evaluate the use of proteome and to reveal disease specific proteolytic peptide, or protein patterns, and lead to the identification of novel proteins for detection of asthma.

The study was not conclusive to detect proteins; no presented pattern could be detected.

Brouwer, A., Visser, C., Duiverman, E., Roorda, R., and Brand, P. (2010). Is home spirometery useful in diagnosing asthma in children with nonspecific respiratory symptoms? *Pediatrics Pulmonology, 45,* 326-332.

Variation in lung function measurement is considered by guidelines to be a useful diagnostic tool in adults, but not studied widely in children. This Dutch study assessed the usefulness of home spirometery in children with nonspecific lower respiratory tract symptoms to diagnose or exclude asthma. School aged children were referred by their general practitioner because of chronic respiratory symptoms of unknown origins. The diagnosis of asthma was made or excluded by pediatric pulmonologist as a gold standard, based in international guidelines and standardized protocol. Peed expiratory flow and forced expiratory flow in 1 sec twice daily for two weeks was done on homo spirometery and variation was calculated.

Symptoms analyzed that made up the testing population were cough and breathlessness, of whom the general practitioner was uncertain about the diagnoses of asthma. ICS was withdrawn for fourteen days and SABA were also withdrawn 8 hours prior to testing; only short acting bronchodilators were allowed, and children were instructed to return to the clinic immediately if symptoms remained uncontrolled. Fraction of exhaled nitric oxide (FeNO) was measured using a portable no meter NIOX MINO Aerocrine Solna Sweden. This was done according to international recommendations. Two weeks later, history physical examination and FeNO Measurements were repeated and bronchial responsiveness was assessed by methacholine provocation use the dosimeter method. During this time, children measured PEF and FEV twice daily on a home spirometery (index test), but results were not revealed to pulmonologist during the study. Spirometery was validated for validity and reliability.

Results: PEF and FEV were considered a poor diagnostic response to asthma testing. Other studies have shown good reliability of the home FEV variation as a diagnostic test. Quality of data must be reviewed.

Brzozowska, A., Majak, P., Grzelewski, T., Stelmach, W., Kaczmarek, J., Stelmach, P., Jerzynska, J., and Stelmach, I. (2009). Measurement of specific airway resistance decreased the risk of delay in asthma diagnoses in children. *Allergy asthma Procedures, 30,* 47-54.

Examine the previous process of diagnoses with risk factor analysis and it's occurrence with pulmonary function test results like spirometery and specific airway resistance (sRaw) and how these measurements contribute to the diagnoses of asthma in children.

- Use of questionnaire in MD office, analysis of MD assessment, notes and this questionnaire to determine delayed asthma diagnoses.
- Need to exclude absence of Atopy, allergic rhinitis symptoms, asthma allergy in a family and living in the single parent families. A whole body plethysmography performed simultaneously with spirometery revealed the underestimation of reverse ability of bronchial obstruction on 16.4 participants.

The reversibility was the only modifiable independent risk factor of the delayed asthma diagnoses. The population reviewed had a mean age 12.6 years old. Results showed the mean age of undiagnosed asthma as 5 years old.

By using the whole-body plethysmography and the spirometery, doctors were able to reveal the underestimation of reversibility of bronchial obstruction leads to the delay in diagnosis of asthma in children.

The results of this study suggest that in children at risk of the delayed asthma diagnosis, with asthma-like symptoms, the spirometery, together with the whole-body plethysmography, should be performed to prevent underestimation of reversibility of bronchial obstruction and to increase the likelihood of early asthma detection.

Bussel et al. (2007). Expert Panel Report 3 (EPR-3): Guidelines for the diagnoses and management of asthma- survey report of 2007. *American Academy of Allergy, Asthma and Immunology, 120(5), 1*-45.

To establish a diagnosis of asthma, the clinician should determine that: Episodic symptoms of airflow obstruction or airway hyperresponsiveness are present. Airflow obstruction is at least partially reversible, measured by spirometery. Reversibility is determined by an increase in: FEV_1 of >200 mL and _12% from baseline measure after inhalation of short-acting B2-agonist (SABA).

Some studies indicate that an increase of 10% of the predicted FEV_1 after inhalation of a SABA may have higher likelihood of separating patients who have asthma from those who have chronic obstructive pulmonary disease (COPD).

<u>A detailed medical history</u>

- Wheeze
- Cough
- Exercise symptoms
- Night symptoms

A physical examination should focus on:

- The upper respiratory tract (increased nasal secretion, mucosal swelling, and/or nasal polyps)
- The chest (sounds of wheezing during normal breathing or prolonged phase of forced exhalation, hyper expansion of the thorax, use of accessory muscles, appearance of hunched shoulders, chest deformity)
- The skin (atopic dermatitis, eczema)

Spirometery can demonstrate obstruction and assess reversibility in patient's 5 years of age. Patients' perceptions of airflow obstruction are highly variable. Spirometery is an essential objective measure to establish the diagnosis of asthma, because the medical history and physical examination are not reliable means of excluding other diagnoses or of assessing lung status. Spirometery is generally recommended, rather than measurements by a peak flow meter, because of wide variability in peak flow meters and reference values. Peak flow meters are designed for monitoring, not as diagnostic tools.

Differential Diagnoses (infants and children)

- Allergy rhinitis
- Airway obstruction large
  - Foreign body
  - Mass or tumor
  - Vocal cord dysfunction
- Airway obstruction small
  - Bronchiolitis
  - Cystic fibrosis
  - Bronco pulmonary dysplasia
  - Heart disease
  - Aspiration

Additional Studies may be useful, but not necessary

- PFT
- VCD
- Bronchoprovocation
- CXR
- Biomarkers
- GERD

Bush, A (2006). Diagnoses of asthma in children under five. *Primary Care Respiratory Journal, 16(1)* 7-15.

Preschool children are known to be unable to perform lung function tests. A therapeutic trial of asthma treatment may be indicated, but a three step protocol is mandatory, stopping therapy if there appears to be a response and only restarting if symptoms recur.

In older children, variable airflow obstruction can be measured before giving a diagnosis of asthma to avoid over diagnoses. Prophylaxis therapy on a long term basis with inhaled steroids in preschool children does not reduce the likelihood of progression to asthma in mid childhood.

All preschool children cough and 50% wheeze before they reach school age. Of those children who have chronic cough, breathless or wheeze and breathlessness, MD must first decide if they are one of five categories:

1. Normal
2. Serious illness such as cystic fibrosis or TB
3. Asthma syndrome
4. Minor health issue with asthma like symptoms
5. Over anxious parents

Assessment is first step in treatment.

Asthma syndrome:

- Chronic lung disease or prematurity
- Post bronchiolitis
- Virus associated wheeze (VAW)
- Atopy associated wheeze
- Obliterative bronchiolitis
- Non-Atopy associated later onset wheeze

Three studies (Tucson, Boston, and Perth) showed that babies with VAQ lung function were abnormal prior to the first episode of wheeze. Popular belief notes that there are no beta receptors in the airway of children less than 1 yr. old. Treatment for each syndrome notes the use of trial medication therapy, to assist with diagnoses. The medication that the children responded to leads the clinical in determining the diagnoses. It is important to note that accuracy to medication administration is crucial to this decision, noting the use of education and spacers to coincide with the accuracy of medical diagnoses.

Three rules of application can be followed by general practitioners in this area to determine referral to specialty.

- If the diagnoses is in doubt
- If the treatment is not working
- If any part of the GP or family is not happy

Callahan, C., Chan, D., Moreno, C., and Mulreany, L. (2006). Increased diagnoses of asthma in hospitalized infants: the next target population for care management? *Journal of Asthma*, *43,* 45-47.

Data was gathered from Department of Defense (DOD) hospitals to analyze admission ages and demographics of asthmatic children.

The mean age for children admitted in 2003 was less than the mean age in 2000 and 2002; in addition, more infants less than 2 years, and were admitted in 2004. This correlates to the rise in diagnoses of asthma in infants and young children over the past 5 years suggesting better recognition of disease is needed. This provides a new target population for early intervention with asthma controller therapy.

Overall rates of hospitalized children are now the same, yet a dramatic increase was noted in the number of children or infants admitted less than 2 years old. It is unlikely that asthma has become more prevalent in those less than 2 years old. The diagnosis of asthma is being made

more commonly in infants. Perhaps, this is due to clinicians becoming more comfortable in making the diagnoses early in children. Consequently, early diagnosis provides for earlier education and intervention in these children.

School age asthma admissions have decreased, showing a positive outcome in asthma management plans for this age group.

Castro-Rodriguez J. (2011). The asthma predictive index: early diagnoses of asthma. *Current Opinion Allergy Clinical Immunology*, *11*, 157-161.

The study aimed to review the importance of determining at an early age which infant/preschoolers will develop asthma later on in life and discuss the utility for the asthma predictive index. The population began with children who have recurrent wheeze at 6 years.

The study identified variable factors: genetic polymorphisms, environmental socio economic, sex, ethnicity and family health beliefs that contribute to the asthma diagnoses.

More studies need to be done in different populations using the Asthma Predictive Index (API) to reaffirm utility.

Carlsten, C., Dimich-Ward, H., Ferguson, Al, Becker, A., DyBuncio. A., Chan-Yeung, M. (2011). Airway hyperresponsiveness to methacholine in 7 year old children: sensitivity and specificity for peadiatric allergis-diagnosed asthma. *Pediatric Pulmonology*, *46,* 175-178.

In diagnoses with lung function and/or airway hyper responsiveness, objective measurement is encouraged by guidelines. Concentrations of methacholine result in 20% drop in FEV_1 (PC 20) of 8 mg/ml considers reasonable threshold for supporting the diagnoses of asthma.

If 8mg/ml is used as the cut off, then there was a higher sensitivity, but less specificity.
This study supports decreasing the number to 2 mg/ml for diagnoses in high risk children age 7 and under. Reasons such as allergic rhinitis that might present additional patients for testing.

Caudri, D., Wijga, A.H., O' Hoekstra, M., Kerkhof, M., Koppelman, G.H., Brunekreef, B., Smit, H., Jongste, J. (2010). *Thorax, 65,* 801-807.

Rationale of the study is that there is still difficulty in predicting whether preschool children with symptoms suggestive of asthma will develop asthma in later childhood. This study measured whether fraction of exhaled nitric oxide (FENO) interrupter resistance (Rint) or specific immunoglobulin E (IgE) in 4 year old children with suggestive symptoms can predict asthma in 8 yr olds.

FENO and specific IgE measured at 4 years old were associated with wheezing and asthma at 8 years old. Both tests also remained significant predictors after mutual adjustment for clinical history. Rint was significantly associated with wheeze at age 6, but not at 7 or 8.

Population came from PIAMA Cohort of children born 1996-1997.

Results showed that in preschool children with symptoms suggestive of asthma, FENO and specific IgE could predict later childhood asthma symptoms up to age 8. There was an added predictive value.

The study method was strong with large population and latitudinal design.

Corderio, D., Rudolphus, A., Snoey, E., and Braunstahl, G. (2011). Utility of nitric oxide for the diagnosis of asthma in an allergy clinic population. *Allergy and Asthma Proceedings, 32,* 119-126.

Fractionated exhaled nitric oxide (FeNO) was determined to be non invasive, with minimal discomfort is recommended.

Guidelines for standardized online and offline measurement of FeNO are available.
There is moderator correlation between FeNO and pulmonary inflammation markers, such as sputum eosinophilia and bronchial biopsies.

Studies have shown the efficacy of FeNO in diagnosing asthma with higher FeNO values in asthmatic patients.

Even after exacerbation, FeNO can be used to monitor asthma after Inhaled Cortico Steroid (ICS) dose.

Recently it was discussed whether this could be a predictor of accelerated lung function decline. The aim of this study was to determine the discriminative value of FeNO for asthma and other atopic conditions in the allergy clinic. The study found correlation between FeNO levels and IgE.

Dallinga, W, J., Robroeks, C., VanBerkel., J., Moonen, E., Godschalk, R., Jobsis, Q., Dompeling, E., Wouters, E., and VanSchooten, F. (2009). Volatile organic compounds in exhaled breath as a diagnostic tool for asthma in children. *Clinical Experimental Allergy*, *40,* 68-76.

The object of the study was to examine a new diagnostic tool that better discriminates between asthma and transient wheezing and that leads to a more accurate diagnosis and hence less under treatment and overtreatment of asthma in young children. Breath samples were obtained to analyze a large number of volatile organic compounds (VOC) to potentially discriminate between various inflammatory conditions.

63 asthmatics and 57 healthy children were analyzed. 945 compounds were subjected to discriminate analysis to find those that could discriminate between disease and healthy children.

Results did show a number of VOC in exhaled air can be used to distinguish children with asthma. Inflammation plays a role in the physiological changes in asthmatic lung disease. Inflammation is accompanied by oxidative stress and therefore lipid peroxidation process converts polyunsaturated fatty acids into VOC that are secreted via the lungs. Elements such as ethane and pentane were found in asthmatic children.

Critique of the results include patient compliance on withholding use of steroid inhalers, as well as the compounds that might be trapped in lung tissue and not be released.

Definition, diagnoses, disease types, and classification of asthma. (2005). *International Archives or Allergy and Immunology, 136 (suppl 1*), 3-4.

Definition of childhood asthma:
Asthma in children is a disease involving repeated attacks of wheezing and dyspnea, which either resolve without treatment or can be relieved or ameliorated by treatment.

Del Col DeFarais, M., Rosa, A., De Souza Hacon, S., Albuquerque De Catro, H., Ignotti, E. (2010). Prevalence of asthma in schoolchildren in Alta Floresta- a municipality southeast of the Brazilian Amazon. *Revista Brasileira de Epidemiologia, 13(1),* 1-8.

A cross sectional study of prevalence of asthma in children (ages 6 and 7 years and adolescents ages 13-14) was done. The methodology used was study of *Asthma and Allergies I Childhood ISAAC phase I* in 2007. Review was done of the students that answered affirmatively to question 2 “Presence of wheezing in the last 12 months”.

<u>Highest prevalence of symptoms included:</u>

- Wheeze in last 12 months
- 1-3 wheezes in last 12 months
- Dry coughing at night
- Male schoolchildren presented a higher prevalence of asthma, physician diagnosed asthma at 4 or more wheezing attacks in the last 12 months
- Teenage boys presented the highest prevalence of speech restricting wheezing
- Alta Floresta presents one of the highest rates of prevalence of asthma in Latin America among school children ages 6 and 7 years

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Diamant, Z., Boot, J.D., Mantzouranis, E., Flohr, R., Sterk, P.J., and Gerth Van Wijik, R. (2010). Biomarkers in asthma and allergic rhinitis*. Pulmonary Pharmacology and Therapeutics*, 23, 468-481.

Biomarker is a physical sign or laboratory measurement that serves as an indicator of pathophysiological response to a therapeutic intervention. The ideal biomarker has characteristics of clinical relevance (sensitivity and specificity for the disease) and is responsive to treatment effects, reliability and repeatability of the sample technique. Obtaining theses noninvasive or semi invasive airway sampling methods were done meeting at least some of these criteria.

In children, measuring of biomarkers is inconsistent across the differing sampling techniques, reflecting three things: diseases heterogeneity, methodological limitations or varying sensitivity of the biomarker detection.

Multiple biomarkers should be obtained to rule out the complex response of airway inflammation, allergic rhinitis, and sampling techniques. Further development of non invasive

sampling methods and biomarker detection techniques are warranted and should enable general application across populations of all ages.

Eigen, H. (2008). Differential diagnoses and treatment of wheezing and asthma in young children. *Clinical Pediatrics*. *47(8),* 765-745.

Diagnosing asthma in young children can be difficult due to the variation in symptoms, type, severity, and frequency of asthma signs. These variations differ among children and differ within one child's report of symptoms at differing times.

Review of the following is important when caring for asthmatic children:

- When to treat
- How to treat
- Assessing the risk of asthma progression in wheeze
- Most effective controller regimen
- When to terminate controller therapy

Tucson Children's Respirator Study states: Those children younger than 3 years with frequent wheeze (e.g., >3 episodes in past year that lasted >l day and affected sleep)' are at increased risk of developing asthma if they have a positive Asthma Predictive Index (API) based on 1 risk factor (atopic dermatitis, or parent with asthma), or 2 of 3 minor risk factors (allergic rhinitis, eosinophilia, or wheezing without a cold).
Modified API= f four or more exacerbations of wheezing in 12 months, with at least 1 physician confirmed exacerbation, allergic sensitization to at least one aero allergen in the major criteria, and replaces allergic rhinitis as a minor criterion with allergic sensitization to milk ,eggs or peanuts.

Symptom variation and comorbidity of bronchitis, viral lower respiratory infection and recurrent upper respiratory tract infection, bronchopulmonary dysplasia, cystic fibrosis, congestive heart failure, and bronciolitis make asthma difficult to diagnose early.

Establishing diagnoses is based on: frequent wheezing, history of asthma in family, patient symptoms, and response to exposure allergens, and the presence of GERD (Gastroesophogeal reflux disease). The API analyzed provides a framework for this process, along with pulmonary function tests (PFT). Conversely, accuracy of PFT has been tested in preschoolers, with 85% production of valid and informative results.

Ferdousi, H.A., Zatterstrom, O. and Dreborg, S (2005). Bronchial hyper-responsiveness predicts the development of mild clinical asthma within 2 years in school children with hay-fever. *Pediatric Allergy Immunology, 16*, 478-486.

Purpose of the study was to investigate whether children with Bronchial Hyper Responsiveness (BHR) but no symptoms of asthma in 1992 had developed clinical asthma at follow up in 1994.

The second purpose was to examine the diagnostic path and properties of test for asthma/allergic inflammation, using doctor diagnosed asthma (DDA), or self assessed symptom of asthma, or iso-capnic hyperventilation of cold air (IHCA) as the standard method to determine differential diagnoses of children with hay-fever.

During both periods, the bronchial hyper-reactivity was estimated by methacholine bronchial provocation tests (MBPT), bronchial variability by peak expiratory flow rate variability, subjective symptoms of asthma by visual analogue scale (VAS) and bronchial inflammation by serum and urine levels of inflammatory mediators.

The authors defined DDA (Doctor diagnosed asthma) as the presence within the last year of at least two of the three symptoms:

- Cough
- Wheeze
- Shortness of breath

The symptoms should be repeated and triggered by stimuli other than infections and be relieved by inhalation of b2-agonists (9).

The authors defined Asthma as:

- Subjective asthma as noted on the VAS during the birch pollen season and after the season, respectively
- A positive cold air provocation test (‡10% decrease in FEV1.0) and or DDA according

It was found that the high frequency of BHR and DDA in our group indicates at least that the group of children at school age asking for allergen immunotherapy are highly at risk of developing asthma. This study revealed that children with hay fever without clinical asthma have a high risk of developing asthma within 2 years. In relation to DDA, inhalation of cold air and the MBPT showed a high sensitivity to diagnosing asthma.

Friedman, T. (2009). Diagnosing asthma in young children: current research and recommendations. *Journal of Pediatric Health Care*, *24,* 305-311.

It is important for primary care nurse practitioners to diagnose asthma in young children in a timely manner so that therapy can be initiated.

Reasons why children are different to diagnose with asthma:

- There is a high incidence of episodic wheeze in respiratory illness
- Ordinary wheeze can be same as asthmatic wheeze.
- Small airway can be irresponsive to bronchodilator therapy
- Viral Induced airway reactivity common in young children
- Pulmonary Function Test's (PFT) like Spirometery, Fixed Expiratory Volume, Forced Expiratory Vital Capacity (FVC): these can reveal poor lung function in patient who are asymptomatic, but could benefit from intervention.
- These require patient performance, following of commands, and physiological capability of performing the required breathing maneuvers.
    - It is assumed less than 5 years old are not able to reliably perform the test

In the latest NAEEP publication (2007), the updated guidelines require PFTs for a complete diagnosis of asthma in children 5 years and older.

Asthma Predictive Index

- Presence of wheezing prior to 3 years of age
- History of Atopy
- Personal history of eczema
- History of asthma in one parent
- Presence of more minor risk factors including
- Eosinophilia,
- Wheezing without colds
- Allergic rhinitis

Eosinophila is a relatively high level of circulating Eosinophila, generally greater than 4% of total white blood cells. Castro Rodriguez notes: "The stringent API has a specificity of 96% to 97% and a sensitivity of 15% to 28%. In contrast, the loose API has a sensitivity of 80% to 82% and a specificity of 40% to 57%. The negative predictive value for both the stringent and loose APIs is high at 87% to 94% "(Castro-Rodriguez et al., 2000).

PFT accuracy- historical studies:

United States (US)- ages 3 to 6 years reported that 78% of participants generated three acceptable curves and as many as 82% of participants generated three or fewer acceptable curves (Eigen et al., 2001).

European - ages 3 to 6 years found that 68% of children had three acceptable forced expirations and only 63% of those had less than a 5% difference between two of the three exhalations.

US- ages 3 to 5 years found that 49% of children generated two acceptable curves and only 26% produced three acceptable curves.

US- in preschoolers using an interactive computer animated system versus the standard candle-blowing software found 68% had acceptable flow curves

The American Thoracic Society (ATS) and European Respiratory Society (ERS) formed a Joint Expert Panel to review the feasibility and reliability of spirometery in young children. This resulted in determining the FEV of 0.5 sec is more physiologically appropriate for young children.

Bronchospasms challenge with methacholine, adenosine monophosphate or exercise are NOT recommended if PFT's are not reliability and easy auscultation for wheeze can be noninvasive, but no reliable data demonstrates recommendation. Discouraging the use of biomarkers, and tissue sampling has been determined due to invasiveness and cost effectiveness.

Future studies include the use of Fractional exhaled nitric oxide (FeNO). FeNO can identify children who present with recent wheezing as having asthma with a sensitivity of 86% and a specificity of 92%, and it can predict asthma exacerbations with a 90% predictive value, making it more sensitive than conventional lung tests.

This study noted that the NAEPP supports the use of diagnostic medications to confirm asthma diagnoses.

Godrey, S. (2009). The use of bronchial challenge to diagnose asthma in preschool children. *Primary Care Respiratory Journal, 18 (1), 10*-14.

The accuracy in the use of acoustic recordings used to detect and analyze breath sounds and to quantify the wheeze during bronchial challenges in children.

Historically the definition to confirm diagnosis of asthma in child was: For the challenge to be positive the pediatrician had to hear wheeze during five breaths (not necessarily consecutive) during a 45 second period of auscultation.

With a recording from Pulmotrack ™, acoustical equipment, the first wheeze appeared during the two minute period of nebulization of stimulant, it was not necessary to stop induction, auscultate and repeat this process until the above qualification was met. This has been tested for validity and accuracy. Benefits include accuracy, time to perform and use of technician vs. MD staff to complete.

Kim, C., Callaway, Z., Fletcher, R., Koh, Y.(2010). Eosinophil-derived neurotoxin in childhood asthma: correlation with disease severity. *Journal of Asthma, 74,* 568-573.

What is clear is of the many mediators released into the blood during eosinophil activation, eosinophil granule proteins (eosinophil cationic protein [ECP], eosinophil derived neurotoxin [EDN], major basic protein, and eosinophil peroxidase) have been the most strongly implicated in the pathophysiology of asthma (8), with ECP being the most studied of the group.

The primary purpose of this study was to evaluate the utility of serum EDN levels as a marker of eosinophil degranulation and its possible correlation with disease severity from blood samples in childhood asthma.

Results showed that EDN levels were significantly higher in the asthma group.

Kim, C., Callaway, Z, Kim, D.W., and Kita, H. (2011). Eosinophil degranulation is more important than eosinophilia in identifying asthma in chronic cough. *Journal of Asthma, 48,* 994-1000.

The children studied were ages 17-15 years old. Sputum induction study that reviewed cell viability. In the asthma group, eosinophil percentages were significantly higher than those in the other groups.

Blood was drawn and markers were run and EDN level was tested. There was no significant difference between EDN levels in the non asthma group. MBP levels in the asthma group were significantly higher than the compare group. A positive correlation was found between MBP and sputum eosinophil. FEV was also compared.

Result: Asthmatic patients had poor FEV. Asthmatics have more eosinophil in sputum. EDN was higher in Asthma group.

Kimpman, J., Simoes, E (2001). Respiratory syncytial virus and reactive airway disease. *American Journal of Respiratory and Critical Care Medicine, 163*, S1.

This article states the need for a better understanding between Reactive Airway Disease (RAD) and asthma. Dr Peter Openshaw reviews and lectures regarding the immunopathogensis for Respiratory Syncytial Virus (RSV) and suggests mechanism for the association, however, debate continues.

Koppelman, G.H., Meerman, G.J., and Postma, D.S. (2008). Genetic testing for asthma. *European Respiratory Journal, 32,*775-782.

Seven asthma genes have been identified. Chromosomal regions can reveal potential novel genes for asthma. *ADAM33* is a chromosome that has been shown to be important in susceptibility to asthma and bronchial hyperresponsiveness. Other genes are still under replication study review. *ORMDL3* is another chromosome in which expression is significantly associated with childhood asthma.

The discussion of predicting asthma by gene assignment is still open. What is compelling is the difference in gene identification and the rise of asthmatics in the US without change in genes. This study also reviewed a study done on farms in Germany, Austria and Switzerland. There was a significant decrease in asthma incidence in children in the rural population. Theories based on exposure to endotoxins that change gene presentation is worth exploring. To date, genetic testing has not been perfected, and those available to the public are not recommended.

Leonardi, N.A., Spycher, B.D., Strippoli, M.P., Frey, U., Silverman, and Kuehni, C.E. (2011). Validation of the asthma predictive index and comparison with simpler clinical prediction rules. *American Academy of Allergy, Asthma and Immunology, 147(6),* 1466-1479.

Object of the study was to: assess the predictive performance of the API in an independent population and compare it with simpler rules based only on preschool wheeze. A modified API was tested in Leicester. Performance was modest and similar to prediction based only on preschool wheeze.

Leung, T.F., Ko, F.W.S., Sy, Y.H., Wong, E., Li, C.Y., Yung, E., Hui, D.S.C., Wong, W.K., and Lai, C.K.W. (2009). Identifying uncontrolled asthma in young children: clinical scores or objective variables. *Journal of Asthma, 46,* 130-135.

This study investigated the ability of Chinese version of Childhood Asthma Control Test (C-ACT) and other disease-related factors in identifying uncontrolled asthma (UA)

Sensitivity and specificity was analyzed and it was determined in this population that C-ACT was better than objective parameters in identifying young Chinese children with uncontrolled Asthma.

Lukrafka, J., Fuchs, S.C., Moreira, L.B., Picon, R., Fischer, G.B., and Fuchs, F. (2010). Performance of the ISAAC questionnaire to establish the prevalence of asthma in adolescents: A population based study. *Journal of Asthma, 47,* 166-169.

In this study the ISAAC questionnaire, was validated in Portuguese.

The eight core questions included: "Did you":

- Ever have wheezing
- Wheezing in the last 12 months
- Ever had asthma
- Ever have symptoms present in the last 12 month, such as:
  - Four or more attacks of wheezing
  - Cough with no cold or respiratory infection
  - Sleep disturbed due to wheezing ≥1 night per week
  - Wheezing due to exercise
  - Speech limitations due to wheezing
- Four additional number of asthma attacks in the last 12 months
- Attended emergency service in the last 12 months because of asthma
- Have you been hospitalized in the last 12 months due to asthma
- Do you need daily use of medications used to treat asthma

Population used to test was mixed 28.9% confirmed with asthma with 41% reported past wheeze. The study confirmed "ever wheezing" was most indicated of asthma diagnoses.

Results examined language barriers, and the suggestion that "wheeze" might indicate other pulmonary sounds, including asthma bronchitis, URI, common cold, "gripe" "resfriado", Pharyngitis and tonsillitis.

Mahut, B., Peyrad, S., Delclaux, C. (2011). Exhaled nitric oxide and clinical phenotypes in childhood asthma. *Respiratory Research, 12* (65).

Study reviewed exhaled FENO to test reliability of results in diagnostic of asthmatic children (age 2.6 yr average).
In conclusion, FENO0.05 is independently linked to two pathophysiological characteristics of asthma (ICS-dependant inflammation and bronchomotor tone), but does not help to identify a clinically relevant phenotype of asthmatic.

Mara, F., Marra, C.A., Richardson, K., Lynd, L.D., and FItzGerld. (2011). Antibiotic consumption in children prior to diagnoses of asthma. *Bio Med Central Pulmonary Medicine*, *11*, 32.

We know that antibiotics are routinely used in children being treated for asthma, due to the fact that symptoms associated with poor asthma control overlap symptoms associated with respiratory tract infections.

The population of this study included ALL live births in British Columbia, Canada from 1997 to 2003. The data was retrieved from electronic personal health files, administrative data from the MSP (physician services and hospital admission) prescriptions from PharmNet.

Asthma diagnosis was found in ICD-9 codes, or two medical fee-for-service claims codes (ICD9) within a moving 12 months period, or two prescriptions for a known asthma medication.

This study showed an increase in the use of antibiotics ultimately diagnosed with asthma, suggesting that clinicians are slow to respond to patterns of asthmatic symptoms.

The study recommends if more than two antibiotics are needed over a six month peiord for respiratory symptoms, the case should be considered for asthma.

Molis, W.E., Bagneiwski, Weaver, A.L., Jacobson, R.M., and Juhn, Y.J. (2008). Timelines of diagnoses of asthma in children and its predictors. *Allergy, 63,* 1529-1535.

Convenience sample of 839 children age 5-13 years was used to conduct a comprehensive medical record review to determine their asthma status by applying predetermined criteria for asthma.

Many asthmatic children are not diagnosed with asthma in a timely manner, especially in those without the commonly recognized factors associated with asthma.

Setting included Rochester Minnesota, where the medical care is contained between two medical systems. All these records used were children enrolled in the Rochester Family Measles Project, recruited from the Rochester school district in Rochester Minn.

This study showed a high or significant population of asthmatic children that were not timely diagnosed with asthma. Predictors for timelines is diagnosing asthma included family history of asthma and the type of the earliest symptom recorded.

Previous studies were confirmed with other predictive findings based on gender, ethnicity and socioeconomic status.

Delay of diagnoses was found in children who reported less commonly recognized risk factors. This provides evidence for healthcare providers to become cognizant that asthma can occur in children without major risk factors.

Nichols, B., Scott, L., Jones, S., Kwong, K., Morphew, T., and Jones, C.A. (2009). Detection of undiagnosed and poorly controlled asthma in a hospital-based outpatient pediatric primary care clinic using a health risk assessment system. *Journal of Asthma, 46,* 498-505.

Object of the study: to determine the rate of undiagnosed and poorly controlled asthma. The study used a computerized health risk assessment system in an urban population.

Software based HRA (Health Risk Assessment) system used survey answer patterns to identify children with probable, uncontrolled and moderate to severe asthma. Children 2 years and older were enrolled. Patients were already enrolled in the HRA system to evaluate the rates of probable and uncontrolled asthma in pediatric outpatient clinic. Parents were asked to complete the survey using the touch screen kiosks in the clinic. Survey response was linked with Medical record number at the clinic.

Study results were consistent with known incidence and prevalence of childhood asthma. Study results indicated that the delayed diagnoses of asthma increased the risk of morbidity event during the interval since their last visit, compared to those who reported previous diagnoses.

Those who are correctly identified and provided treatment at this facility had a reduced risk of subsequent morbidity event.

Niggerman, B., Nilsson, M., Friedrichs, F.(2008). Paediatric allergy diagnosis in primary care improved by in vitro allergen-specified IgE testing. *Pediatric Allergy Immunology, 19,* 325-331.

The trial was a prospective study performed at 14 pediatric primary care practices in Germany, covering 380 children below 6 years of age.

The aim of this study was to investigate the influence of in vitro allergen-specific immunoglobulin E (IgE) testing on the primary care physician's diagnosis and clinical management of children with symptoms of eczema, wheezing/asthma and rhinitis.

In this study, the availability of IgE test results to the primary care physician had an impact on the decision making process of the diagnosis, but not on the pharmaceutical or avoidance advice given. The clinicians remarkably changed their way of making diagnosis when they were able to use the IgE test results. They were able to reduce the group of uncertain diagnoses from 80% to 20%.

Pederson (2007) Preschool asthma-not so easy to diagnose. *The Primary Care Respiratory Journal, 16 (1),* 4-6.

This article examines the use of Standardized questionnaires such as those on (http://www.asthmacontrol.com/asthmacontroltestchild.htm.)

This use has not been fully validated in children under four. The frequent episodes of wheeze, activity induced cough or wheeze nocturnal cough or awakenings in periods without viral infections and no seasonal variation in symptoms and symptom after the age of three are all highly suggestive of (but to specific to) asthma.

Pedersen, S.E., Hurd, S.S., Lemanske, R.F, Becker, A., Zar, H.J., Sly, P.D., Soto-Quiroz, M., Wong, G., and Bateman, E.D. (2011). Global strategy for the diagnoses and management of asthma in children 5 years and younger. *Pediatric Pulmonology, 46,* 1-17.

Object of the study was to assist with the epidemic problem of the variation of asthma clinical symptoms in children 5 years and younger.

To aid in the diagnosis of asthma in young children, a symptoms-only descriptive approach that includes the definition of various wheezing phenotypes has been recommended.

In 1993, the Global Initiative for Asthma (GINA) was implemented to develop a network of individuals, organizations, and public health officials to disseminate information about the care of patients with asthma while at the same time assuring a mechanism to incorporate the results of scientific investigations into asthma care.

Since that time, the Global strategy for asthma management and prevention in children 5 years and younger has been established to assist with management of asthma symptoms.

This includes difficulties with diagnoses, efficacy and safety of drugs and drug delivery systems, and data collection on new therapies

TABLE 1—Differential Diagnosis of Asthma in Children that must be ruled out:

- Years and Younger
- Infections
- Recurrent respiratory tract infections
- Chronic rhino-sinusitis
- Tuberculosis
- Congenital problems
- Tracheomalacia
- Cystic fibrosis
- Bronchopulmonary dysplasia
- Congenital malformation causing narrowing of the intrathoracic
- airways
- Primary ciliary dyskinesia syndrome
- Immune deficiency
- Congenital heart disease
- Mechanical problems
- Foreign body aspiration
- Gastroesophageal reflux

A diagnosis of asthma in young children can often be made based largely on symptom patterns and on a careful clinical assessment of family history and physical findings.

The presence of Atopy or allergic sensitization provides additional predictive support, as early allergic sensitization increases the likelihood that a wheezing child will have asthma.

Peroni, D.G., Pietrobelli, and Boner, A.L. (2010) Asthma and obesity in childhood: on the road ahead. *International Journal of Obesity, 34*, 599-605.

This article will examine the clinical settings, in which physicians must be cautious about diagnosing asthma in obese children on the basis of self reported symptoms alone and should confirm the diagnosis by using objective measurements and marker evaluations that can better identify asthma phenotype and exclude over diagnosis.

Physiological differences in mechanical airway of obsess child:

- Decreased tidal volume
- Decreased functional residual capacity
- Decreased elastic property of chest wall
- Decreased force of retractile lung parenchyma

- Airway smooth muscle affected by paradoxical increase response to normal parasympathetic tone or other bronchial constricting agents.
- Chronic airway inflammation
- Gastric reflux disease
- Exercise intolerance
- Obesity increases work of breathing

Hypothesis that obsess child breathing at normal rate with low tidal volume does not allow the normal stretching of airway smooth muscle during breathing.

This protective device is reduced in both asthmatics and obese patients. The net effect is more substantial airway smooth muscle contraction and airway narrowing.

If an asthma diagnosis is made in obese children, it is usually more difficult to control rather than emergent in exacerbation.

Prado, O.S., Perez-Yarza, E.G., Ruiz, A.A., Murua, J.K., Elosegui, P.C. Aramburu, J.M., Knorr J.I. (2011). Fraction of exhaled nitric oxide and asthma predictive index in infants less than two years old. *Archivos de Broncneumologia, 47 (5),* 234-238.

This study examined the exhaled FE 10 (Fraction of exhaled Nitric Oxide) in the non cooperative child under the age of 3 (between 2 months and 2 years) to assists with asthma diagnoses.

A cross sectional design occurring over 4 months of time examined post prandial multiple breaths and flow spirometery using a stationary chemiluminescence analyzer.

38 patients were tested, and success was carried out on 32. Mean age was 10.9 (+ or – 5 months). The cases with a positive asthma predictive index (API) had significantly higher FE10 values than those with negative API.

Thus the relationship between API and FE 10 in the online tidal breathing was positivity established.

Rachelefsky, G., Kennedy, S., and Stone, A (2006). Introduction: Enhancing the role of the emergency department in the identification and management of childhood asthma. *Pediatrics. 117 ,* S57.

The American Academy of Allergy, asthma and Immunology (AAAAI) convened a task force of asthma experts to raise the standards of care for children with asthma.

This created the pediatric asthma initiative stated below:

- Managing ED care with tracking system for characterizing asthma and asthma care patterns, provide EBP education and follow up to families.
- Five health plans seeking to improve the health and health related AOL quality of life for children with asthma developed and sustained a partnership with community stakeholder and institutionalizing clinical models in asthma care.

- Created Allies Against Asthma, again enhancing quality of life of children with asthma, reduced hospital admission, ED visit and missing school days.
- Improving childhood asthma outcomes in the United States, a blueprint for policy action formulating six policy goal and eleven policy recommendations.
- University of Michigan developed tools and training to improve pediatric asthma management by clinicians, to build a large cadre of opinions, leaders and trainers, who educate primary care physicians in delivering asthma care.

Sigurs, N (2001). Epidemiologic and clinical evidence of a respiratory syncytial virus-reactive airway disease link. *American Journal of Respiratory and Critical Care Medicine, 163,* S2-S6.

This article examined clinical evidence that supported the link between Respiratory Syncytial Virus (RSV) and Reactive Airway Disease (RAD). It is noted that RAD and Bronchiolitic symptoms resemble the symptoms of asthma, and that treatment is the same with bronchodilators having a modest effect. Treatment of wheezing with corticosteroids in infants with RAD shows similar results as asthma as well.

The authors suggested that results from studying children, support the theory that that 33% of the time, RSV Bronchiolitis in infancy that is severe and requires hospitalization, could influence the mechanism involved in the development of asthma and allergies. This author found the highest frequency of asthma when the children previously discussed above reached age 7.5, regardless of family history of asthma.

Townshend, J., Halis, S., and McKean, M (2007). Diagnoses of asthma in children. *British Medical Journal (335),* 198-202.

Presentation of asthma can be either atopic asthma or episodic viral wheeze. With the appropriate physical assessment, health history peak flow monitoring and allergy testing, a child can usually be determined to have atopic asthma, non atopic asthma, or episodic viral wheeze, with an episodic pattern, persistent features, or both; and with a mild, moderate, or severe pattern.

Turktas, I, Harmanci, K., and Bakirtas, A. (2006). Diagnostic accuracy of skin prick testing in young children with asthma. *Pediatric Pulmonology (41)* 386-387.

This article is a letter to the editor validating that the skin prick testing (SPT) was found to demonstrate an informative, easy and safe diagnostic aid in all young children with asthma, especially of mild severity. Children included in the study were all ages 6-15 years with a referral for respiratory symptoms on an outpatient basis.

Early aeroallergen sensitization is the most important risk factor for asthma in children. Atopy is the defining character that eludes the patient to developing uncontrolled asthma. A positive Atopy or reaction to the SPT determined uncontrolled asthma. The relationship was determined to be more effective that testing non asthmatics who have reported allergies with inhaled corticosteroid therapy.

Ulrik, C.S., Postma, D.S., and Backer, V (2005). Recognition of asthma in adolescents and young adults' objective measure is best? *Journal of asthma, 42*, 549-554.

Airway responsiveness to histamine, diurnal peak-flow variability, and bronchodilator reversibility cannot be used interchangeably as markers of asthma in epidemiologic studies. On the basis of the present findings, "airway hyperresponsiveness (AHR) to a nonspecific bronchoconstrictor" is recommended as the objective marker of asthma-related airway libility. In the population convened by a survey sample of adolescents and young adults ages 13-23, use of AHR as the only objective marker of asthma identified 93% of the participants with current asthma.

Van Wonderen, K.E., Van Der Mark, L.B., Mohrs, J., Geskus, R.B., Van Der Wal, W., Van Aalderen, W.M.C., Bindels, P.J.E., and Ter Riet, G. (2008). Prediction and treatment of asthma in preschool children at risk: study design and baseline data of a prospective cohort study in general practice (ARCADE). *Bio Med Central Pulmonary Medicine, 9 (13),* 1-9.

The objectives of the study are to cross validate the use of the Airway Compliance and Asthma Development (ARCADE) predictive rule. This will be done by: (1) identification of predictors for asthma in preschool children at risk for asthma with the aim of cross-validating an earlier derived prediction rule; and (2) compare the effects of different treatment strategies in preschool children.

Population consisted of 1-5 year old Netherland children selected from general practices, determined to be at risk for asthma as evidence by recurrent coughing (≥2 visits) wheezing (≥1 visit) or shortness of breath (≥1 visit) in the previous 12 months. This prospective study will continue with no published evidence of effectiveness at this time.

Von Jagwitz, M., Pessler, F., Akmatov, M., Jialiang, L., Dipl-Math, U.R., and Vogelberg, C (2011). Reduced breath condensate pH in asymptomatic children with prior wheezing as a risk factor for asthma. *Journal of Allergy and Clinical Immunology, 124 (1),* 50-55.

Exhaled breath condensate (EBC) pH measurement has not been applied to preschool children prior to this study. This study reviewed young asymptomatic children at risk of asthma using the combination of recurrent wheezing and Atopic sensitization as a proxy for high risk asthma.

The findings of this study constituted the first report that EBC pH values are significantly reduced in asymptomatic atopic children with a history of recurrent wheezing, and thus their measurement might potentially serve as a noninvasive, cost-effective prognostic test that can be performed during an asymptomatic interval to determine the diagnoses of asthma in preschool children.

Wasser, T., Miller, R., and Pilacik, A (2006). Using graphical and statistical software to diagnose pediatric asthma with vocal cord dysfunction (VCD). *AMIA 2006 Symposium Proceedings,* 1138.

Diagnoses of Vocal Cord Dysfunction (VCD) concurrent with diagnoses of Vocal Cord Dysfunction Asthma made by the visual inspection of the spirometery loops displayed on paper or on a monitor. Findings continue to display value in a differential diagnosis and will incur further testing with computer algorithm accuracy.

WinklerPins, V., Walsworth, D.T., and Coffey, J. (2011). How best to diagnose asthma in infants and toddlers? *The Journal of Family Practice, 6 (3),* 152-154.

Differential diagnoses found in infants and toddlers provide a challenge in diagnosing asthma. Recurrent wheezing, colds, physician diagnosed eczema or atopic dermatitis, eosinophilia and parental history of asthma increase the probability of subsequent asthma diagnoses. The European and United States expert panel guide to the diagnoses and treatment of asthma in childhood, PRACTALL, states that asthma should be suspected in any infant with recurrent wheezing and cough.

Yamada, Y, and Yoshihara, S. (2010). Creola bodies in infancy with respiratory syncytial virus bronciolitis predict the development of asthma. *Allergology International, 59 (4*), 375-380.

The presence of Creola Bodies (CrB's) in infant sputum indicated epithelial damage. This damage is a considerable risk factor on the development of recurrent wheezing in infants, and a predictor of asthma within at least five years.

III. Adequacy of Management of Asthma

Summary

Asthma Management/ED Visits

The National Heart, Lung, and Blood Institute (NHLBI) guidelines were developed in 1992 and revised in 1997, 2002, and 2007 to optimize asthma management at multiple points of care including primary care settings, Emergency Departments (EDs), and inpatient hospitalizations. The guidelines include the major concepts of: Diagnosis, Four Components of Care, Stepwise Approach, and Managing Exacerbations. The Four Components of Care encompass: 1. Assessment and Monitoring, 2. Education, 3. Control Environmental Factors and Comorbid Conditions, and 4. Medications. Additional detail on the NHLBI recommendations is included in a table below. The importance of managing asthma care consistent with the guidelines was stressed throughout this literature review.

It is recognized that there is variation in the management of acute pediatric asthma within the ED. It is also essential that all members of the pediatric ED health care team be informed, educated, and updated on the current asthma treatment guidelines to ensure best practice and high quality outcomes.

General points of ED asthma management include:

- Patient assessment: baseline readings of respiratory rates, pulse rate, peak flow readings
- Presence/severity of other symptoms
- Administration of steroids as a key treatment in any exacerbation
- Need for hospital admission based upon response to treatment

The key to management of the patient in the ED is the measurement of the severity of an acute asthma exacerbation. A thorough assessment is needed to guide initial therapy. The selection of appropriate treatment is important to improve short term outcomes. In an acute asthma exacerbation recommended treatments include the following:

- Inhaled beta$_2$ agonists
- Supplemental oxygen
- Combination therapy of inhaled ipratropium bromide (Atrovent) to each inhalation of a beta$_2$ agonist to increase effectiveness
- Interventions to reduce the incidence of hospital admissions:
    - Oral corticosteroids within 45 minutes of onset of symptoms
    - Inhaled corticosteroids

There are sources included in this review that speak to interventions performed within the ED environment that contribute to positive asthma management. It was demonstrated that multidisciplinary programs consistent with practice guidelines implemented in the ED resulted in improvements in documentation, treatment, reassessment, and plan for the asthma patient.

There are few studies on the characteristics of children who present to the ED for asthma care. It has been demonstrated that parents of children who have primary care physicians (PCPs) prefer the ED because they felt that their child required care emergently. There are also situations in which the parents contact the PCP and are instructed to present to the ED. Additionally there are families who don't have a primary care provider.

PCP (Primary Care Physician) Capacity/Knowledge/Skill

There are a number of variables that impact asthma care management by the PCP. Studies demonstrate that PCPs do not consistently utilize practice guidelines for asthma. PCPs are unable to identify the four classes of asthma and step therapy based upon asthma severity. Limited knowledge of medications and dosing is also cited. Research that was focused on the education of the PCP, has demonstrated more comprehensive asthma management. The literature supports that when the PCPs have enhanced education on the asthma guidelines and implement tools to promote adherence to the guidelines, this results in a reduction in ED visits and hospital admissions.

Despite the best efforts of the PCP, there are cases that respond poorly to recommended therapy for any number of reasons. The PCP is crucial in determining those patients who have poorly controlled asthma and necessitate a referral to a specialist. Referral to a specialist should be considered for any patient whose asthma is difficult to control. The asthma guidelines recommend that primary care physicians consider referral for patients under the following circumstances:

- Patients who have experienced more than 2 oral corticosteroid bursts per year
- Patients with a recent exacerbation requiring hospitalization
- Patients who required therapy at step 4 or higher to achieve adequate asthma control
- Patients for whom immunotherapy is being considered.

Asthma Education

As noted above, asthma care management occurs in multiple settings. A crucial point of care that must be integrated into the process is the home. Asthma visits to the ED are often precipitated by asthma exacerbations that occur at home and are poorly managed in the home for a variety of reasons. In the NHLBI guidelines, the expert panel recommends that a written asthma action plan be provided for all patients with asthma. A key aspect of education is preventing life-threatening exacerbations. A patient cannot achieve asthma control without knowledge of what constitutes asthma control, the use of inhaler devices, and the importance of medical and non-medical interventions.

Studies have demonstrated that parents and children's ability to evaluate symptom severity is poor and requires improvement. Findings suggest that missed opportunities to relieve symptoms and provide appropriate home therapy results in ED visits and hospital admissions. Parents and children receive instructions on home management of asthma from multiple sources including: the pediatrician, the ED, an asthma specialist, after hours call centers and during hospital admissions. Without a coordinated effort among the disciplines, this can be a source of confusion.

This literature review notes a number of studies on a variety of programs on patient education. They range from the PCP providing education in the office setting to comprehensive asthma programs, based on a partnership between schools, parents, and pediatricians. Additionally, internet education is also noted.

Most agree that asthma education should minimally include:

- Explanation of the mechanisms of asthma
- Trigger factors and avoidance
- Pattern of symptoms
- Explanation of the difference between maintenance and symptomatic treatment

- Instruction and practice of appropriate medication therapy and correct inhalation technique
- Explanation of the effects of tobacco smoke exposure
- Discussion of role of allergen exposure and avoidance
- Monitoring:
    - Home monitoring of symptoms or peak flow
    - Instruction on self-management: what to do when asthma deteriorates

Because asthma education is such a complex intervention, evaluating the effects of this intervention with evidence-based medicine techniques is difficult. Most agree that asthma education is useful but results with respect to outcomes is lacking. Common sense dictates that these improvements can best be realized through a partnership between the health care team, the child with asthma and his or her parents.

Bibliography

Note: Due to the overlap in concepts between Construct II and Construct III, this bibliography is intended for both constructs.

Action Plans in Asthma. (2005). Retrieved March 21, 2012, from Drug and Therapeutics Bulletin - BMJ Journals: http://www.dtb.bmj.com, Dec; 43(12):91-4

Article cited a study in the UK: In a study involving 1,292 attendances of adults and children with asthma at 100 UK emergency departments during a census week, one-fifth (20.8%) had been kept awake due to asthma for more than 3 nights before attendance. The duration of symptoms prior to attendance suggests that patients could benefit from a prompt, contained in a written personal asthma action plan, that helps them to judge what level of increase in symptoms or reduction in peak flow should trigger them to increase their medication or seek medical assistance. Conclusion: UK national guidelines recommend that healthcare professionals offer self-management education including a written personalized asthma action plan to patients with asthma. In patients with moderate to severe asthma, such an approach appears to improve lung function and school attendance, and reduce symptoms and healthcare utilization. The evidence is less convincing for patients with milder asthma, particularly in primary care.

Allcock, D. (2009). Using a community respiratory service to reduce children's hospital admissions. *Changing Practice* , *105*(4), 22-23.

Study evaluated the utilization of an advanced pediatric nurse practitioner as a community matron in delivering tailored education service to children and families in their homes/environments to reduce respiratory hospital admissions.

In a one year period:

- Potentially 53 emergency visits and 82 emergency admissions were averted.
- 81% of parents stated that since seeing the community matron their understanding of their child's condition had improved significantly.
- Nearly two-thirds noted since being case managed by the service they could manage their child's condition more effectively.

- Over three-quarters stating they had to visit their GP less often and 69% felt the number of admissions had been reduced.
- An improvement in parental educational knowledge and attitude surrounding dealing with exacerbations and reductions in GP and hospital visits was shown.

American Academy of Family Physicians. (2005). *Information from Your Family Doctor [Brochure].*

Pamphlet handed out by PCP in the office setting. Provides brief overview of dealing with the child's asthma

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Amado, M., & Protnoy, J. (2006, Jan-Feb). Recent advances in asthma management. *Missouri Medicine, 103*(1), 60-64.

Effective treatment of asthma cannot occur without a diagnosis. Diagnosis is made utilizing spirometry when possible but in very young children the diagnosis is primarily clinical. The National Asthma Education and Prevention Program (NAEPP) guidelines stress the importance of a partnership between the patient and care provider. The National Heart, Lung, and Blood Institute (NHLBI) base treatment on levels of severity: intermittent, mild, moderate, and severe persistent. Levels of severity are patient specific and contingent upon a number of variables. Most important treatment is to identify triggers and avoid exposure. It is important to teach patients how to respond to exacerbations.

Asthma Center of Lancaster Services. (n.d.). Retrieved April 6, 2012, from Asthma Center of Lancaster - Lancaster Regional Medical Center: www.lancasterregional.com

On-line notice about the Asthma Center at the Lancaster Regional Medical Center in Philadelphia. The center employs an Asthma Educator to work with asthma patients and their families in collaboration with their physicians to improve quality of asthma care.

Asthma Office Checklist. (2003). Retrieved April 6, 2012, from Security Health: www.securityhealth.org/.../SHP-pdf-asthma_office_visit_checklist.1

Office checklist designed in accordance with The National Asthma Guideline (NAEPP).

Boyd, M., Lasserson, T. J., McKean, M. C., Gibson, P. G., Ducharme, F. M., & Haby, M. (2010). Interventions for educating children who are at risk of asthma-related emergency department attendance. *The Cochrane Collaboration*, 1-116.

This review included a total of 38 studies and 7843 children. Educational intervention delivered to children, their parents, or both who present to the emergency department for acute exacerbations was shown to significantly reduce risk of subsequent emergency department visits (RR 0.73, 95% CI 0.65 to 0.81, N = 3008) and hospital admissions (RR 0.79, 95% CI 0.69 to 0.92, N = 4019) with the risk of subsequent emergency department visits following educational intervention reduced by just over a quarter. There were also fewer unscheduled doctor visits (RR 0.68, 95% CI 0.57 to 0.81, N = 1009). There remains uncertainty as to the

long-term effect of education on other markers of asthma morbidity such as quality of life, symptoms and lung function as very few data were available for other outcomes (FEV1, PEF, rescue medication use quality of life or symptoms) and there was no statistically significant difference between education and control.

This review also found the nature and delivery of educational intervention varied between the studies and authors were not able to identify the exact characteristics of educational interventions (such as type, duration, and intensity) which were most effective in reducing acute care utilization. However, there is evidence to suggest that many hospital admissions could be prevented if children and their parents were given and used an individualized asthma management plan, had greater general knowledge of asthma, complied with their preventive treatment, commenced appropriate medication early during an asthma attack and sought local medical assistance early if their condition was not improving (Ordonez 1998).

Brooten, D., Cohn, S., Youngblut, J. M., Lobar, S. L., Royal, S., & Hernandez, L. (2008). Outcomes of an Asthma Program: Healthy Children, Healthy Homes. *Pediatric Nursing* , *34*(6), 448-455.

The Healthy Children Healthy Homes community education program, available in Spanish and English, was shown to be a valuable tool in asthma prevention and management with significantly greater perceived asthma susceptibility and knowledge about common household triggers and fewer asthma misconceptions post-intervention.

The program was carried out in a Catholic elementary school community in northern Miami, Florida and consisted of:

- Two 90-minute educational sessions with Asthma Amigos
- 8-week diffusion of asthma information in the community
- Educational sessions with 276 school children (grades 1 to 8)
- Asthma fair

The program offered a broader intervention strategy alternative considering the high prevalence of asthma in urban, low income, minority communities and the inability to effectively target all current and potentially asthmatic children.

Brouwer, A. F., & Brand, P. L. (2008). Asthma education and monitoring: what has been shown to work. *Paediatric Respiratory Reviews* , *9*, 193–200.

Clinical heterogeneity is highlighted as an issue within 4 described Cochrane Library systematic reviews regarding educational strategies in childhood asthma. Within that context, the components of asthma educational packets are summarized understanding any given educational approach may be useful in some children with asthma but not others.

Many children with asthma use their inhaler incorrectly due to lack of proper instruction yet it was also found poor inhalation technique was also common in children who had received inhalation instruction in primary care.

The determinants of correct inhalation technique in 200 children illustrated that childhood asthma can be well controlled and normal lung function maintained with extensive education, training in the correct use of the inhaler device, and close follow-up. Adherence to maintenance

medication and correct use of the inhaler device are key factors in obtaining asthma control. Achieving and maintaining proper inhalation technique requires time and repeated effort.

Brown, R., Bratton, S. L., Cabana, M. D., Kaciroti, N., & Clark, N. M. (2004). Physician Asthma Education Program Improves Outcomes for Children of Low-Income Families*. *Chest Journal* , *126*(2), 369-374.

An interactive physician seminar that has been shown to improve patient/parent satisfaction and decrease emergency department visits for children with asthma was found to be effective for children from low-income families.

- Low-income treatment group children were significantly less likely to be admitted to an emergency department (annual rate, 0.208 vs 1.441, respectively) or to a hospital (annual rate, 0 vs. 0.029, respectively) for asthma care compared to children in the control group.
- The low-income children in the treatment group tended to have higher levels of use of controller medications, to receive a written asthma action plan, and to miss fewer days of school, although these differences were not statistically significant compared to low-income children in the control group.

Buckner, E. B., Hawkins, A. M., Stover, L., Brakefield, J., Simmons, S., Foster, C., et al. (2006). Knowledge, Resilience, and Effectiveness of Education in a Young Teen Asthma Camp. *Pediatric Nursing* , *31*(3), 201-210.

A 3-day experience in a traditional camp setting was coordinated for the purposes of providing a positive outdoor experience and developmentally appropriate asthma education for twelve teens ages 12 to 14. Both Caucasian and African American ethnicities and low socio-economic and moderate to high socio-economic groups were represented in both female and male cohorts.

Results comparing the pre and post-camp assessments of knowledge showed:

- An overall increase in camper knowledge and an increase in two of three areas.
- Campers and parents stated they learned much about asthma and its management.
- Resilience was evident throughout the camp and after camp as the teens noted increased comfort, less fear, and more self-control of their asthma.

The camp provided opportunity for asthma education using materials developed for teens and it was both well received and effective. All campers stated the camp was a good experience for kids with asthma. Parents and campers noted the positive effect and normalcy associated with the friendships formed at the camp.

Burns, D. (2004, February 10). The management of exacerbations of acute asthma in primary care. *NursingTimes.net, 100*(6), 48. Retrieved April 6, 2012, from http://www.nursingtimes.net/nursing-practice/clinical-specialisms/asthma/the-management-of-exacerbations-of-acute-asthma-in-primary-care/204556.article

Asthma is a chronic inflammatory condition of the airways. The pathophysiology includes: bronchoconstriction, edema of the airway wall, and mucous hypersecretion. General points of management include: Patient assessment, baseline readings of respiratory rates, pulse rate,

peak flow readings, presence/severity of other symptoms. Administration of steroids is key treatment in any exacerbation. Need for hospital admission is based upon response to treatment. Guidelines state that hospitalized patients should be referred to their own General Practitioners' in two working days. Patients should be provided with an asthma action plan. Patients should be able to identify when their asthma is out of control, and under what circumstances to obtain expert help.

Bush, A., & Sejal, S. (2010, September 4). Management of severe asthma in children. *The Lancet, 376*(9743), 814 - 825.

Review focused on children with problematic severe asthma (that does not respond to treatment). There is substantial morbidity with this group and the evidence base for management is lacking. There are 4 domains of severity in children with asthma:

1. Level of current prescribed treatment
2. Level of current baseline control of asthma over at least the preceding month
3. Immediate past burden of asthma exacerbations, including number and severity
4. Future risk of complications, including: risk of failure of normal postnatal airway growth; risk of future loss of asthma control; risk of future exacerbations; risk of phenotype change from episodic, viral, to multi-trigger

The review noted that referrals to specialists are usually prompted by symptoms, safety concerns with respect to medication, and risk subsequent to admission to intensive care. It is important to evaluate whether the asthma is true "severe therapy-resistant asthma" as opposed to being: not asthma at all, mild asthma exacerbated by co-morbidities, or difficult to treat due to poor adherence or poor inhalation techniques.

There is a need for further study on new approaches to management of children with severe asthma. The current best approach, thorough multidisciplinary assessment should produce results with conventional treatments.

Butz, A. M., Syron, L., Johnson, B., Spaulding, J., Walker, M., & Bollinger, M. E. (2005). Home-Based Asthma Self-Management Education for Inner City Children. *Public Health Nursing* , *22*(3), 189—199.

Home-based clinical trial including two hundred twenty-one children with asthma found:

- A targeted home-based asthma education intervention can be effective for improving symptom identification and appropriate use of medications in children with asthma.
- Home asthma educational programs should address accurate symptom identification and a demonstration of asthma medication delivery devices.

Cavazos, G. (2006, Jul-Aug). Asthma in emergency department. Guidelines, physicians and patients. *Revista Alergia Mexico, 53*(4), 136 - 143.

Study conducted to determine causes of high morbidity and mortality due to bronchial asthma. Retrospective study of 152 patients (88 pediatrics) seen by emergency medical services 234 times during one calendar year. Four variables investigated:

1. Number of patients who were diagnosed with bronchial asthma
2. Number of patients prescribed regular treatment with inhaled corticosteroids

3. Number of patients compliant with regular treatment with inhaled corticosteroids
4. The existence of collaboration among the different levels of medical services (emergency service, outpatient service and asthma specialists)

Results (of the 88 pediatric patients):

- Only one had been diagnosed with asthma in accordance with international guidelines.
- Only 41 had been prescribed a preventive anti-inflammatory treatment in a regular manner with inhaled corticosteroids.
- 23 demonstrated good compliance to inhaled corticosteroids.
- 15 used B-2 agonist bronchodilators for treatment.
- There was no evidence of any type of communication between the medical services for any of the patients studied.

There is a lack of knowledge with respect to the guidelines for treatment of asthma among emergency physicians. This lack of knowledge contributes to treatment failures and patient confusion. Strategies for implementation of international guidelines for the treatment of asthma have failed. Steps must be undertaken to facilitate compliance with evidence-based guidelines in order to reduce worldwide morbidity and mortality.

Chan, D. S., Callahan, C. W., Sheets, S. J., Moreno, C. N., & Malone, F. J. (2003). An Internet-based store-and-forward video home telehealth system for improving asthma outcomes in children. *Am J Health-Syst Pharm* , *60*, 1967-1981.

The adherence and disease control outcomes associated with the use of an Internet-based store-and-forward video home telehealth system to manage asthma in children were studied. Ten children participated. A total of 321 videos of inhaler use and 309 videos of peak flow meter use were submitted. Disease control was assessed by examining quality of life, utilization of services, rescue-therapy use, symptom control, satisfaction with home telemonitoring, and retention of asthma knowledge.

- Inhaler technique scores improved significantly in the second study period.
- Submission of diagnostic monitoring videos and asthma diary entries decreased significantly.
- Peak flow values as a percentage of personal best values increased significantly.
- Overall, there was no change in quality of life reported by patients. However, the caregivers in the virtual-education group reported an increase in the patients' quality-of-life survey scores.
- Emergency department visits and hospital admissions for asthma were avoided. Rescue therapy was infrequent.
- A high rate of satisfaction with home telemonitoring was reported.

Internet-based, store-and-forward video assessment of children's use of asthma medications and monitoring tools in their homes appeared effective and well accepted.

Chetney, R. (2003). Home Care "Life Coaches" Help Kids Win The Asthma Game. *Caring Magazine* , 58-65.

The Asthma Life Coach Program utilized registered nurses who specialize in pediatric asthma care in the role of “life coach” to improve outcomes for children in the highly populated, mostly urban area of Southeastern Virginia. Since the onset of the program, over 600 children have been provided assessment, teaching, and monitoring to promote self-care activities by the home care nurses. Findings from a study evaluating 294 children while enrolled in the program were highlighted:

- 45% drop in hospital admissions
- 17% drop in emergency room visits
- 19% decrease in primary care physician visits
- Overall health care costs decreased by 45%, inpatient days by 78% and average length of stay from 3.4 to 2.5 days (Axelrod, 2001).

More recent results showed that patients who continue to participate in the program sustain these improvements. For children enrolled through 2002, the decrease in hospital admissions continues to climb to the 60 percent range.

A study limitation in contacting children from low-income transient families without phone access was highlighted. A program using telemonitoring within schools was also utilized to expand program reach and results showed a decrease in hospital admissions, ER visits, and a reduction of missed school days.

Chiang, L.-C., Huang, J.-L., Yeh, K.-W., & Lu, C.-M. (2004). Effects of a Self-Management Asthma Education Program in Taiwan Based on PRECEDE-PROCEED Model for Parents with Asthmatic Children. *Journal of Asthma* , *41*(2), 205-215.

Study was conducted to evaluate the comparative effectiveness of two different asthma educational programs. One was self-management asthma education based on the PRECEDE-PROCEED model to change the influential factors based on a previous need assessment study in Taiwan. The other consisted of regular outpatient asthma education.

Detailed results follow:
1) Asthma knowledge, self-efficacy, perceived effectiveness, children’s cooperation, and self management behaviors significantly improved after the self-management asthma educational program based on PRECEDE-PROCEED. Except for perceived effectiveness, all variables still had good effectiveness after 6 months of follow-up. The experimental group was better than the control group in knowledge, children’s cooperation, and self-management behaviors at the 3-month follow up, as well as in knowledge and children’s cooperation at the 6-month follow-up.
2) In both the experimental and control groups, the educational program had a good impact on the health outcome. The average degree of drug use was reduced from 2.7 to 2.1. The number of visits was reduced from 4.75 to 3.55 per half year in the experimental group, and from 5.8 to 3.48 in the control group. The severity of asthma was reduced from 2.7 to 2.1. The signs/symptoms of asthma decreased, school absenteeism was reduced, and exercise ability improved after education at the 6-month follow-up in both groups.

It was concluded the theory-based educational program had a good effect on self-management behaviors. The trend indicated that educational effects were sustained for at least 3 months, with some for 6 months. Authors suggest in order to maintain the educational effects, further specific series of educational programs can be designed based on the patterns of self

management behavior stages every 6 months. The effects of health outcomes may show significant differences using longer follow-up times in future clinical trials.

Chini, L., Iannini, R., Chianca, M., Corrente, S., Graziani, S., LaRocca, M., et al. (2011). Happy Air, a Sucessful School-Based Asthma Educational and Interventional Program for Primary School Children. *Journal of Asthma* , *48*, 419-426.

Study was undertaken to investigate whether a comprehensive asthma program, based on a partnership between schools, parents, and pediatricians, can improve the management of asthma and the quality of life for children with asthma. The program provided educational intervention to families, school staff, and students, including asthma diagnosis and management tools and extracurricular activities to improve respiratory and psychological conditions.

Authors concluded the program provides a model for an education- and school-based intervention for children with asthma and their families. The multi-action program for diagnosis, clinical follow-up, education, self-management, and quality-of-life control aims to minimize the socioeconomic burden of asthma.

Chipps, B., & Murphy, K. (2005, Sep). Assessment and treatment of acute asthma in children. *The Jounal of Pediatrics, 147*(3), 288-294.

Article focused on the assessment of acute pediatric asthma with review of recent studies pertaining to treatment. The measurement of the severity of an acute asthma exacerbation is an important guide to treatment and response to therapy. Characteristics identifying patients at a particular risk for life-threatening deterioration are:

- Infants < 1 year old
- Prior history of life-threatening exacerbation
- Less than 10% improvement in PEF in the emergency department
- PEF or FEV1 < 25% of predicted value
- PCO2 ≥ 40mm Hg
- Wide daily fluctuations in PEF
- Patient cannot recognize airflow obstruction

Guidelines emphasize the need for a thorough assessment to guide initial therapy. It is extremely important to select the appropriate treatment for each patient to improve short-term outcomes. β2-adrenergic agonists (β-agonists) are the most effective known bronchodilators and have been the first-line treatment of acute childhood asthma for several decades. There are a number of considerations with respect to the delivery of β-agonists that are important to positive clinical outcomes. These include: types of β -agonist, doses, and delivery systems. Recent data have shown that the addition of ipratropium bromide (IB) to β-agonists improves outcomes in acute pediatric asthma. The response to IB is variable, but there is very little risk from the addition of 250 mg IB to β-agonist treatment. There is extensive data that supports the use of systemic corticosteroids (CS). The use of CS early in the course of treatment maximizes the chance for successful treatment. When severe asthma is refractory to therapy then Magnesium sulfate, methylxanthine and Helium-oxygen may be tried in an effort to avoid noninvasive or mechanical ventilation. After successful treatment, it is imperative that the patient receive a written asthma management plan and a follow-up appointment in 3 to 7 days.

Cicak, B., Verona, E., & Mihatov-Stefanovic, I. (2008). An Individualized Approach in the Education of Asthmatic Children. *Acta Clin Croat* , *47*, 231-238.

Study aimed to assess whether an individual education program in addition to the classic group education program for asthmatic children and their parents would lead to better control of the disease. Study monitored 58 asthmatics (children over seven years of age, diagnosed with chronic asthma according to the GINA guidelines and monitored for one year prior to receiving individual education, and their parents) during the year before and year after receiving an individual educational program.

Study results showed the number of asthma exacerbations ($p<0.0001$), hospitalizations due to asthma ($p=0.0236$) and days with asthmatic symptoms ($p<0.0001$) to have significantly reduced, along with significant increase in FEV 1 ($p<0.0001$) and lower mean ICS does ($p<0.0001$) upon completion of individual educational program.

It was concluded that the addition of individual education in the treatment of asthmatic children enables better control of the disease (lower number of hospitalizations and asthma exacerbations, increased FEV 1) with a lower mean ICS dose.

Clark, N. M., & Valerio, M. A. (2003). The role of behavioural theories in educational interventions for paediatric asthma. *Paediatric Respiratory Reviews* , *4*, 325-333.

Authors contend successful asthma interventions have been based on theoretical principles and have generally combined strategies for preventing and managing an asthma episode and managing the social and behavioral factors associated with the disease. The authors review the role of social and behaviorial factors in asthma, highlight findings regarding social/behavioral factors and strategies, and evaluate improvements in asthma control associated with theory-based interventions.

It is concluded that controlling pediatric respiratory disease requires a significant change in the behavior of all stakeholders: patient, family, clinician, community and health system. Authors note many asthma interventions do not achieve change because they fail to teach patients how to observe, make judgments and react appropriately to their change efforts (operationalize sound behavioral theory) and good theory can explain how to bring about change.

Clark, N. M., Mitchell, H. E., & Rand, C. S. (2009). Effectiveness of Educational and Behavioral Asthma Interventions. *Pediatrics* , *123*(S3), 185-192.

Studies of individualized and community-based interventions for control of asthma in children are discussed.

Authors posit that successful programs share 8 common characteristics:
(1) Recognition of the multiple factors affecting childhood asthma;
(2) Careful assessment of participants' risk factors and needs;
(3) Tailoring of program elements to address participants' risk factors and needs;
(4) Consideration of both physical and social environments;
(5) Use of sound learning and change theories;
(6) Family involvement;
(7) Focus on children with the most serious disease; and

(8) Selection of delivery venues at which learning can be optimized.

Challenges for moving practice and research forward are also presented.

Cloutier, M., Hall, C., Wakefield, D., & Bailit, H. (2005). Use of Asthma Guidelines by Primary Care Providers to Reduce Hospitalizations and Emergency Department Visits in Poor, Minority, Urban Children. *The Journal of Pediatrics, 146*, 591-597.

Study conducted to determine whether a systematic, standardized, asthma disease management program (Easy Breathing™) would increase adherence by primary care physicians (PCPs) to the 1997 National Asthma Education and Prevention Program (NAEPP) guidelines. The study included children enrolled in the program between June 1,1998 – August 31, 2002 and focused on anti-inflammatory therapy and whether greater adherence was associated with a decrease in hospitalizations and emergency department (ED) visits in low-income, minority children who resided in Hartford, Connecticut.

The Easy Breathing™ program focused on four elements of care: diagnosing asthma, determining asthma severity, prescribing therapy appropriate for the asthma severity, and developing a written Asthma Treatment Plan that is given to the family.

48% of 3748 children with a confirmed diagnosis of asthma had persistent disease. Results demonstrated a 25% increase in the use of inhaled corticosteroids. Provider adherence to guidelines for anti-inflammatory therapy increased from 38% - 96%. Children enrolled in the program demonstrated an overall 35% decrease in hospitalization and a 27% decrease in ED visits.

The study demonstrated the effectiveness of a disease management program based upon the NAEPP guidelines in reducing asthma morbidity in a large group of low-income, urban, minority children whose asthma was managed entirely by PCPs.

Coffman, J. M., Cabana, M. D., Halpin, H. A., & Yelin, E. H. (2008). Effects of Asthma Education on Children's Use of Acute Care Services: A Meta-analysis. *Pediatrics* , *121*(3), 575-586.

A meta-analysis to estimate the effects of pediatric asthma education on hospitalizations, emergency department visits, and urgent physician visits for asthma is presented.

Of the 208 studies identified and screened, 37 met the inclusion criteria. Twenty-seven compared educational interventions to usual care, and 10 compared different interventions. Among studies that compared asthma education to usual care, education was associated with statistically significant decreases in mean hospitalizations and mean emergency department visits and a trend toward lower odds of an emergency department visit. Education did not affect the odds of hospitalization or the mean number of urgent physician visits. Findings from studies that compared different types of asthma education interventions suggest that providing more sessions and more opportunities for interactive learning may produce better outcomes.

It was concluded that providing pediatric asthma education reduces the mean number of hospitalizations and emergency department visits and the odds of an emergency department visit for asthma, but not the odds of hospitalization or the mean number of urgent physician

visits. Health plans should invest in pediatric asthma education or provide health professionals with incentives to furnish such education.

Authors note additional research is needed to determine the most important components of interventions and compare the cost-effectiveness of different interventions.

Colland, V. T., van Essen-Zandvliet, L. E., Lans, C., Denteneer, A., Westers, P., & Brackel, H. J. (2004). Poor adherence to self-medication instructions in children with asthma and their parents. *Patient Education and Counseling* , *55*, 416-421.

This study describes a self-treatment program for parents of children with asthma. The aim was to prevent asthma exacerbations by learning to recognize prodromal signs and acting upon them by increasing inhaled corticosteroids (ICS).

The study questions were:
(1) Can we teach parents and children to recognize prodromal signs?
(2) Are instructions to increase inhalation medication followed?
(3) Will frequency and severity of asthma attacks diminish subsequently?

Twenty-nine children of the age of 4–11 years with moderate asthma, participated in the one year prospective randomized study. Structured information was given to all patients on asthma, symptoms and medication. The experimental group received additional information on recognizing prodromal signs and doubling ICS during one week.

Results found that only in 25% of the patients who recognized prodromal signs the dose of ICS was doubled (as prescribed), in 75% inadequately or not at all. Recognition of prodromal signs was poor as well as compliance to increase as-needed medication. No significant decrease of asthma symptoms occurred in the experimental group.
It was concluded that the use of prodromal signs to start off self-treatment activities in order to prevent asthma exacerbations is not feasible for all children with asthma. Poor symptom perception, poor compliance and no full acceptance of the illness all influence the use of a stepwise self-treatment program. Clinical implications are important for self-treatment instructions: an individually tailored and multi-component program should be offered by health care providers in order to help the patient to recognize early alarm symptoms, comply to self-treatment instructions and to make adaptations for continuous self-regulation.

Costa, M. R., Oliveira, M. A., Santoro, I. L., Juliano, Y., Pinto, J. R., & Fernandes, A. L. (2008). Educational camp for children with asthma. *J Bras Pneumol.* , *34*(4), 191-195.

Study to evaluate the impact of a 5-day educational camp program for children with asthma in terms of improving their knowledge of asthma and enhancing their performance in the use of inhaled medication and in physical activities. A total of 37 children with asthma, aged 8-10 years (15 females and 22 males), were included and conclusions noted the camp program can improve knowledge about specific questions, encourage participation in physical activities, and improve the asthma management skills of children. Detailed results follow: 1) 25% showed an improvement in the level of knowledge of asthma after the educational camp program, as evidenced by the greater number of correct answers on three of the twelve questions analyzed ($p < 0.05$). 2) The exercise-related dyspnea scores decreased significantly ($p < 0.05$). 3) The

ability to use inhaled medication correctly was significantly improved after the intervention ($p < 0.05$).

Courtney, A., McCarter, D., & Pollart, S. (2005, May 15). Childhood Asthma: Treatment Update. *American Family Physician, 71*(10), 1959-1968. Retrieved April 6, 2012, from http://www.aafp.org/afp/2005/0515/p1959.html

Article summarizing the treatment of asthma in children, based upon new modalities and recent studies as of 2005. Asthma treatment should be tailored to the severity of asthma. The goal of therapy is to reduce wheeze and cough, reduce the risk and number of acute exacerbations.

In an acute asthma exacerbation recommended treatments include the following:

- Inhaled $beta_2$ agonists
- Supplemental oxygen
- The addition of inhaled ipratropium bromide (Atrovent) to each inhalation of a $beta_2$ agonist is more effective than the $beta_2$ agonist alone.
- Shown to reduce the incidence of hospital admissions:
    - Oral corticosteroids within 45 minutes of onset of symptoms
    - Inhaled corticosteroids

For long-term medical treatment inhaled corticosteroids are standard for maintenance therapy. Studies have shown that inhaled corticosteroids are more effective than inhaled long-acting $beta_2$ agonists. Some studies have demonstrated that inhaled corticosteroids provide better control than oral montelukast. Nedocromil and cromolyn have not shown to be as effective as inhaled corticosteroids in children. The use of oral theophylline is not recommended in children because of the potential for serious side effects.

Other interventions included education of parents and children. Education should include:

- Recognition and avoidance of triggers
- Understanding the use of medications:
    - Proper dose
    - Method of administration
    - Timing of administration
- Treatment compliance and monitoring

Cowan, S., Ernst, P., Cartier, A., & Boulet, L.-P. (2004). A population-based evaluation of a regional asthma education centre. *Can Respir J*, *11*(1), 39-44.

Study conducted to determine the impact of a regional asthma education centre on reducing asthma-related morbidity and improving the quality of prescribing in adult and youth populations. A conclusive association between the establishment of the asthma education centre and changes in health care use or the quality of prescribing could not be demonstrated.

Cowie, R. L. (2003). Written Self Management Plans Improve Asthma Control. *Canadian Respiratory Journal , 10* (3), 157.

One page "summaries" of papers presented at a 2002 meeting. Author notes that most guidelines emphasize that patient education is important. A patient cannot achieve asthma control without knowledge of the use of inhaler devices, what constitutes asthma control, and without knowledge of the role of medical and non-medical interventions. Most importantly a key aspect of education is the prevention of life threatening exacerbations. Conflicting conclusions of two Cochrane Reviews were noted however although there is admittedly incomplete evidence, it is difficult to conclude that written asthma action plans should not be a part of asthma management.

Davis, A., Brown, A. S., Joan, E., & Tager, I. B. (2008). Identification of Education of Adolescents with Asthma in an Urban School District: Results from a Large-scale Asthma Intervention. *Journal of Urban Health: Bulletin of the New York Academy of Medicine* , *85*(3), 361-374.

This study was conducted to evaluate a school-based, population-level system to identify, prioritize, and provide interventions for middle school children with asthma in a large urban school district in Oakland, CA. Authors noted, in general, community-based public health interventions to reduce asthma morbidity have had modest success due in part to their limited reach and low participation by the targeted population with adolescents especially difficult to reach.

It was concluded large school districts with incomplete or inadequate health records, high asthma prevalence, and internal or external services available for students with asthma may benefit from a similar model. A system such as the one described may be an effective public health strategy for school districts, health departments, and community coalitions addressing asthma or other conditions with high childhood prevalence.

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de Asis, M. L., & Greene, R. (2004). A Cost-Effectiveness Analysis of a Peak Flow-Based Asthma Education and Self-Management Plan in a High-Cost Population. *Journal of Asthma* , *41*(5), 559–565.

Article details literature review of randomized clinical trials comparing peak flow-based (PFB) action plans, symptom-based (SB) action plans, and usual care/no action plan (NAP) was performed. Review was done to analyze the cost-effectiveness of peak flow-based action plans in reducing costs associated with ER visits and hospitalizations due to acute asthma exacerbation in a population of high-risk and high-cost patients, defined as patients with moderate to severe asthma with a history of recent urgent treatment in the ER or hospitalization due to asthma.

Authors noted cost-effectiveness and cost benefit analyses reveal that for high-cost patients, a peak flow-based asthma education and self-management plan program is the most cost-effective alternative in reducing costs associated with ER visits and hospitalizations due to asthma exacerbation. Further refinements to this cost-effectiveness analysis were suggested, including measuring changes in drug use and costs and patients' productivity losses as they may demonstrate additional cost-savings due to peak flow-based asthma education plans.

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de Mingo, A., Campos, A., Ferrer, L., & Lopez, S. (2009). Medical Audit on Children with Asthma in an Emergency Department. *Allergol Immunopathol (Madr), 37*(4), 198-202.

Retrospective medical record audit conducted in Spain to evaluate adherence to international guidelines for asthma management. Four domains were reviewed: evaluation, examination, diagnostic resources, and treatment and conditions at discharge. 50 records were reviewed for patients aged 2 – 14 during the time frame of January – March 2007.

Results demonstrated opportunity for improvement. For evaluation the grading of severity was only recorded in 18% of the cases. With respect to examination, auscultation was recorded in 100%, but respiratory frequency only in 49%, and peak flow ws not recorded in any of the cases. Of the cases treated in the ED (78%), only 12 % were treated with systemic corticosteroids.

The following weaknesses were identified in the treatment of children with asthma:

- Failure to determine the degree of severity
- Lack of specification of the details of the crisis (prior duration, treatment at home, supportive treatment)
- Inadequate asthma background history
- Deficient recording of respiratory frequency and peak flow

Diette, G., Fuhlbrigge, A., Allen-Ramey, F., Hopper, A., Saijan, S., & Markson, L. (2011). Asthma Severity in Patients Initiating Conroller Monotherapy versus Combination Therapy. *Journal of Asthma, 48*(3), 304-310. doi:10.3109/02770903.2011.555034

Study to evaluate differences in asthma control between patients administered asthma controller monotherapy versus combination therapy. Despite the availability of guidelines, there is limited information with respect to the initiation of asthma controller medication and whether it is consistent with guideline recommendations. This study included children 5–16 years; *n* = 488. Asthma control before therapy, and asthma-related resource use were assessed for patients initiating monotherapy and combination therapy. Most of the patients (93 %) received prescriptions for controllers from their primary care physician (PCP) as opposed to the emergency room or after hospital discharge. PCPs were responsible for the care of most of the children (78.6 %). The PCPs were more likely to prescribe monotherapy, specialist were more like to prescribe combination therapy, (84 % vs. 75 %). Results demonstrated there were no significant differences in asthma control score between patients receiving monotherapy and combination therapy. The study was limited by lack of information with respect to patient/physician interactions which may have influenced decision making. Additional study is indicated to determine decision making processes in the prescribing of medications.

Dinakar, C., & Reddy, M. (2004, January). The Yellow Zone in Asthma Treatment: Is it a Gray Zone? *Annals of Allergy, Asthma & Immunology, 92*(1), 7-16.

Review of available literature on methods of preventing and minimizing exacerbations and to identify potential for improvement. The National Institutes of Health (NIH) guidelines support that physicians give patients written action plans with instructions on managing home (yellow zone) exacerbations. According to the guidelines, patients enter the yellow zone when they

experience an increase in asthma symptoms. At issue is that criteria used to identify the yellow zone are not clear and often confusing to patients and care providers. Additionally the guidelines are lacking in recommendations for yellow zone treatment strategies. The review reinforced the use of action plans with effective strategies for patients to follow. The role of controller medication use in managing the green zone was also recognized. Translating the NIH guidelines into realistic clinical practice requires a clearer and more patient-friendly definition of the yellow zone, and this improved definition will facilitate the prescription of effective interventions in the management of yellow zone exacerbations.

Dinakar, C., Van Osdol, T. J., & Wilble, K. (2004). How Frequent Are Asthma Excerbations in a Pediatric Primary Care Setting and Do Written Asthma Action Plans Help in Their Management? *Journal of Asthma , 41* (8), 807-812.

As there are limited studies evaluating the usefulness of the asthma action plan in children, this study was conducted to determine exacerbation frequency and usefulness of the asthma action plan in managing exacerbations that occur in a pediatric primary care setting. In the National Heart, Lung, and Blood Institute Guidelines for the Diagnosis and Management of Asthma, the expert panel recommends that a written asthma action plan be provided for all patients with asthma. It was concluded: approximately four of five asthmatic children seen in the study primary care setting experienced a yellow zone exacerbation at least once during a 3-month period. One third experienced at least one red zone episode. Nine of every 10 caretakers with an action plan reported the asthma action plan to be of value in managing exacerbations.

Dombkowski, K., Fauziya, H., Wasilevich, E., & Clark, S. (2010). Spirometry Use Among Pediatric Primary Care Physicians. *Pediatrics*, 126;182. doi:10.1542/peds.2010-0362

Study conducted to explore the use of spirometry in primary care settings. The National Asthma Education and Prevention Program (NAEPP) Expert Panel Report guidelines stress the importance of spirometry in the initial diagnosis of asthma and then annually for ongoing management. It is suspected however that spirometry use by pediatric primary care physicians for asthma is limited. In response to a 4 page survey addressing knowledge, attitudes, and practices regarding spirometry, 360 respondents demonstrated the following:

- 52% used spirometry in clinical practice
- 80% used peak flow meters
- 10% used no lung function tests
- Only 21% routinely used spirometry for all guideline-recommended clinical situations
- More family physicians than pediatricians reported using spirometry (75% vs. 35%)
- Family physicians had a greater comfort level in interpreting spirometric results
- One-half of respondents interpreted correctly the spirometric results in a standardized clinical vignette
- The frequency of underrating asthma severity increased with the inclusion of spirometric results.
- Time and training were cited most often as the most common barriers to the use of spirometry

It was concluded that the use of spirometry in primary care settings for children with asthma does not conform to national guidelines. Improved adherence to guidelines would necessitate

educational initiatives to address deficiencies in spirometry interpretation and overcoming other barriers.

Dostaler, S., Olajos-Clow, J., Sands, T., Licskai, C., Minard, J., & Lougheed, M. (2011, December). Comparison of asthma control criteria: importance of spirometry. *Journal of Asthma, 48*(10), 1069-1075.

Study conducted to quantify differences in the classification of asthma control using Canadian Thoracic Society (CTS) Asthma Management Consensus Summary and Global Initiative for Asthma (GINA) guidelines composite indices with and without spirometry. Asthma control ratings calculated according to CTS and GINA criteria were compared. Although the CTS and GINA indices classified the same proportion of individuals as having asthma control, they classified different individuals as having controlled and uncontrolled asthma. The spirometry threshold was the main reason for the discrepancy. When spirometry is not utilized, asthma control is consistently overestimated. Failure to include spirometry may underestimate future risk of exacerbations.

Dritz, M., & Britto, M. (2010, April 21). Update on asthma management: making sense of the guidelines for adolescents with asthma and integrating them into clinical practice. *Adolescent Medicine State of the Art Reviews, 2*, 1-20.

Review of evidence-based guidelines on asthma care as published in 2007 by the National Heart, Lung, and Blood Institute's National Asthma Education and Prevention Program Expert Panel (NAEPP). Review conducted to highlight the severity of childhood asthma, the need for improved asthma management in the United States, and to propose a framework that clinicians can use to optimize asthma management and improve clinical outcomes for their patients.

Summary of key NAEPP recommendations:

- Establish asthma diagnosis
- Maintain good asthma control
    - Assessment & monitoring
    - Education
    - Control environmental factors and comorbid conditions
    - Medications
- Stepwise approach
- Managing exacerbations

Despite findings that consistent evidence-based asthma management improves clinical outcomes, implementation of guidelines is poor. In order to promote improvement it is suggested that health care providers employ a strategy to promote quality improvement. Recommended steps to accomplish this:

- Identify the patient population
- Understand current delivery system
- Conduct small test changes
- Expand scope of tests as improvement process results in desired change.

An organization’s asthma care should be evaluated against the NAEPP guidelines. The ultimate goal for improving asthma care will depend on performance in accordance with the guidelines.

Ducharme, F. M., Noya, F., McGillivray, D., Resendes, S., Ducharme-Benard, S., Zemek, R., et al. (2008). Two for one: A self-management plan coupled with a prescription sheet for children with asthma. *Can Respir J , 15* (7), 347-354.

Study conducted to develop a unique written self-management plan based on scientific evidence and expert opinion, test the self-management plan for clarity and perceived relevance in children and their parents, and create a suitable design that facilitates its adoption by health care professionals. Two self-management plans were designed for clinics and acute care settings, respectively. The plans were divided into zones identified by symptoms with optional peak flow value and designed in triplicate format with a prescription slip, a medical chart copy and a patient copy.

It was concluded that the written self-management plans were perceived to be relevant by children, adolescents and their parents. Whether use of the self-management plans will improve patients' compliance with maintenance therapy, asthma education and medical follow-up, remains to be tested.

Eid, N. S. (2004). Update on National Asthma Education and Prevention Program Pediatric Asthma Treatment Recommendations. *Clinical Pediatrics* , 793-802.

The National Asthma Education and Prevention Program (NAEPP) published an update on selected topics from the 1997 Guidelines for the Diagnosis and Management of Asthma and provided new evidence-based recommendations for asthma treatment.

- Selected topics on the long term management of asthma in children addressed the efficacy of inhaled corticosteroids (ICSs) compared with other asthma medications (i.e., as-needed B2-adrenergic agonists and other controllers) in mild and moderate persistent asthma and the safety of long-term ICS use.
- The effects of early intervention with ICSs on asthma progression also were evaluated.
- An important new aspect of the treatment update entails the recommendation of ICSs as the controller medication of choice for all severities of persistent asthma in children.
- Additionally, on the basis of studies in adults, the Expert Panel suggested that long-acting B2-adrenergic agonists are now the preferred adjunct to ICSs in children with moderate or severe persistent asthma.
- Based on long-term data in children, ICS therapy was deemed safe in terms of growth, bone mineral density, ocular effects, and hypothalamic pituitary adrenal axis function.

Conclusion: Although members of the NAEPP Expert Panel determined that the effects of early intervention with ICSs on decline in lung function have not been adequately studied, they found that the effects on asthma control were substantial.

Garbutt, J., Highstein, G., Nelson, K., Rivera-Spoliaric, K., & Strunk, R. (2009, December). Detection and home management of worsening asthma symptoms. *Annals of Allergy, Asthma and Immunology, 103*(6), 469-473.

Study conducted through structured interviews of parents with young children with asthma who had at least one episode of exacerbation requiring urgent care in the past year. The study focused on parents monitoring of the children's' signs and symptoms, if they noticed antecedent

signs and symptoms, and when and how they intervened. Parents reported receiving instructions on home management of asthma from multiple sources including: the pediatrician, the ED, an asthma specialist, after hours call centers and during hospital admissions. Results demonstrated variability among the action taken by the parents in addressing their child's needs. The findings suggest missed opportunities to relieve symptoms, provide appropriate home therapy and prevent failures of home care resulting in ED visits and hospital admissions. The evaluation of symptom severity by parents and children is poor and this need to be improved upon. The primary care provider is key to this process by reviewing details of home management so that parents understand when and how to manage worsening asthma symptoms at home.

Gibson, P. G., & Powell, H. (2004). Written Action Plans for Asthma: An Evidence-Based Review of the Key Components. *Thorax* , 94-99.

Randomized control trials (n=26). Study undertaken to determine impact of individual components of written action plans on asthma outcomes. The study acknowledged variability in the components of the action plans but strongly supported the use of individualized complete written action plans.

Grammatopoulou, E. P., Stravrou, N., Myrianthefs, P., Karteroliotis, K., Baltopoulos, G., Behrakis, P., et al. Validity and reliability evidence of the Asthma Control Test-ACT in Greece. *The Journal of Asthma Volume , 48* (1), 57-64.

Studies conducted to evaluate the validity of the Asthma Control Test (ACT) in Greece. The ACT evaluates 5 criteria:

- Activity limitations in work/school
- Night awareness due to asthma symptoms
- Perceived breathlessness
- Perceived asthma control

The study did demonstrate that the ACT is valid and reliable in Greek outpatients. Additionally the study demonstrated that although 78% of the patients preferred to consult with a specialist, only 55% of the participants of the study had regular follow-up appointments. Patients with better follow-up had improved asthma control.

Guarnaccia, S., Lombardi, A., Gaffurini, A., Chiarini, M., Domenighini, S., D'Agata, E., et al. (2007). Application and implementation of the GINA asthma guidelines by specialist and primary care physicians: a longitudinal follow-up study on 264 children. *Primary Care Respiratory Journal , 16* (6), 357-362.

The Global Initiative for Asthma (GINA) in conjunction with the "World Project for Treatment and Prevention of Asthma" has been promoted by the National Heart Lung and Blood Institute (NHLBI) and the World Health Organization (WHO) as a global plan for treating asthma and spreading the use of guidelines. A study was conducted in Italy involving a working group of primary care physicians (PCPs) and specialists who developed a GINA-based clinical pathway. The basis of the pathway was to ensure appropriate asthma diagnosis, classification and treatment of children with asthma.

The PCPs participated in all of the study cases while the asthma diagnosis had to be confirmed by a specialist. The study was completed by 264 of 416 children who entered the project. Study results demonstrated:

- The guidelines were followed by 94.6% of the PCPs.
- 98.6% of the children learned to manage exacerbations.
- Half the patients with persistent symptoms improved.
- Maintenance treatment was suspended in 47.2% of the cases, reduced in 27.6%, and increased in 4.9%.
- Asthma severity diminished and the need for medications for exacerbations was significantly reduced.

It is important to note that this study focused on interaction between the PCP and specialist at the offset in order to facilitate utilization of the guidelines in a standardized manner. The study also made note of a network of providers including physicians, nurses, school personnel, pharmacists and coaches who have collaborated toward improving quality of life for asthmatic children and their families. Shared protocols in addition to shared clinical data enhanced improved self-management. Having the PCP be part of a larger network of care practitioners improved patient trust.

It was concluded that an integrated and structured protocol in accordance with recommended guidelines for the treatment of asthma contributed to the quality of life for children with asthma.

Halterman, J. S., Kitzman, H., McMullen, A., Lynch, K., Fagnano, M., Conn, K. M., et al. (2006). Quantifying preventive asthma care delivered at office visits: the Preventive Asthma Care-Composite Index. *The Journal of Asthma, 43* (7), 559-564.

Study conducted on the development of an index to quantify preventative asthma care provided in the primary care physician's office. The preventative actions evaluated were as follows:

- Preventive medication actions
- Direct actions to improve asthma
    - Treating comorbidity
    - Specialist referrals
    - Providing asthma action plan
- Discussions of preventive measures related to asthma
    - Environmental changes
    - Adherence to asthma medications
    - Medication instructions

Scores were weighted based upon on the intensity of the action as determined by the National Asthma Education and Prevention Program (NAEPP) guidelines. Results demonstrated that the composite index increased with asthma severity. This was anticipated as children with severe symptoms require more care. Additionally, the index was highest for asthma-related visits as opposed to well-child visits.

In conclusion the study proved beneficial in identifying the usefulness of a composite index designed to provide quantitative data for preventive actions related to asthma during office visits. This is supported by significant correlations with asthma severity and type of visit and suggests potential use for future research and quality improvement efforts for preventive care of children with asthma.

Halterman, J. S., McConnochie, K. M., Conn, K. M., Yoos, L., Callahan, P.M., et al. (2005). A Randomized Trial of Primary Care Provider Prompting to Enhance Preventive Asthma Therapy. *Archives of Pediatrics & Adolescent Medicine*, *159*, 422-427.

Study conducted involving children ages 3 – 7 years with mild persistent/severe persistent asthma. The objective of the study was to determine if school-based asthma screening followed by notification of the provider would prompt providers to take preventive medication action. Results demonstrated that although school-based asthma screening identified symptomatic children in need of medication modification, provider notification did not improve preventive care. Potential reasons that the prompt was not effective:

- Providers disagreement with school-based assessment
- Provider lack of familiarity with guidelines
- Lack of adherence to guidelines
- Prompts delivered at a time when the patient was not physically present in the office of the provider

The effectiveness of communication transfer was not realized in this study. Findings suggest that more aggressive interventions are required to promote improved treatment of children with asthma.

Horner, S.D. (2008). Childhood asthma in rural environment, implications for clinical nurse specialist practice. *Clinical Nurse Specialist, 22 (*4), 192-200.

The object of this study was to indentify factors impacting asthma morbidity in rural school age children. The population reviewed was children ages 2-5 years old, which had current asthma. Previous studies indicate a lower prevalence of asthma in rural areas, with fewer asthma symptoms days and fewer allergic triggers. Thoughts regarding allergens, seasonal crops, dust and dander are frequently higher in rural areas.

Asthma triggers that were higher in rural areas included:

- Pesticide spraying of crops
- Waste/dump sites located in rural rather than urban areas
- Bacterial endotoxins from farm animals
- Air pollution (ozone, indoor carbon monoxide, methane gases)

Rural children differences in asthma:

- Less likely to be sensitive to domestic pet dander (e.g., cats, dogs)
- Were more sensitive to farm animals (e.g., horse, cow, pig, storage mites)

Results indicated that rural children asthma severity is significantly associated with parent asthma management, absenteeism, and hospitalization, but not with ED visits.

Indinnimeo, L., Bertuola, F., Cutrera, R., DeBenedictis, F., DiPietro, P., Duse, M., . . . Barbato, A. (2009, Oct-Dec). Clinical evaluation and treatment of acute asthma exacerbations in children. *International Journal of Immunopathology and Pharmacology, 22*(4), 867-878.

Update on treatment of asthma exacerbations in children by an Italian Pediatric Society Task-force. Work conducted by a panel of experts in 2007-2008. The objective was to provide indications on the use of the drugs most used in children with asthma, grading the quality of evidence and the strength of recommendations. Suggestions were made on limits due to reported unlicensed and off-label use. The level of evidence and the strength of recommendations demonstrate that the use of drugs in children is often extrapolated from the treatment in adults and that more studies are required to endorse the correct use of different drugs in asthmatic children.

Kanis, J., Lovell, J., Bowman, M., & Titus, M. (2011, June). Focused assessment of patients with asthma in the emergency department. *Clinical Pediatrics, 50*(6), 529-534.

Asthma remains a common cause for presentation to the emergency department. Numerous studies have demonstrated that adherence to asthma guidelines in the ED have been effective in appropriate patient assessment, drug therapy and patient education. There is little evidence with respect to the initiation of a clinical asthma score (CAS) and protocol in the ED and whether it leads to more aggressive therapy resulting in more patients discharged to home from the ED.

In an effort to evaluate this, a retrospective study of children age 2 – 18 years was conducted to determine if adoption of a CAS with asthma guidelines results in identification of patients with more severe asthma and factors that predict the need for hospitalization.

Following initiation of CAS and guidelines, the ED multidisciplinary team implemented the new practices. It was noted that there ws significant improvement in documentation, treatment, reassessment, and plan. Although the overall admission rate ws not reduced, patient needs were addressed more clearly and earlier in the course of treatment.

Kondo, N., Nishimuta, T., Nishima, S., Morikawa, A., Aihara, Y., Akasaka, T., . . . Yoshihara, S. (2010). Japanese pediatric guidelines for the treatment and management of bronchial asthma 2008. *Pediatrics International, 52*, 319-326.

The fourth version of the Japanese Pediatric Guidelines for the Treatment and Management of Bronchial Asthma 2008 (JPGL 2008). The guidelines are revised from the JPGL 2005 and are different from Global Initiative for Asthma guideline (GINA). Updates include:

- A classification system of asthma severity
- Recommendations for long-term management organized by age
- Special mention of infantile asthma
- Emphasis on prevention and early intervention

Lefevre, F., Piper, M., Weiss, K., Mark, D., Clark, N., & Aronson, N. (2002). Do Written Action Plans Improve Patient Outcomes in Asthma? An Evidence-Based Analysis. *Journal of Family Practice , 51* (10), 842-848.

Systematic review of published studies. Although written action plans are widely used, there is insufficient evidence to determine whether their use, with or without peak flow monitoring, improves outcomes. Existing trials have tended to overestimate the effects of action plan-based interventions.

Macias, C. G., Caviness, A. C., Sockrider, M., Brooks, E., Kronfol, R., Bartholomew, L., et al. (2006). The Effect of Acute and Chronic Asthma Severity on Pediatric Emergency Department Utilization. *Pediatrics , 117*, S86.

Study conducted in 4 participating emergency departments (EDs) in Texas. The objective was to teach emergency department (ED) physicians the use of standardized criteria for diagnosing and classifying asthma severity. An additional objective was to describe patterns of pediatric ED utilization of the criteria for classification of both acute and chronic asthma severity. The study included 4 participating EDs, 84 physicians, and 6222 individual pediatric ED encounters over a 2-year time frame.

Results demonstrated that physicians who completed the education module learned to effectively diagnose asthma and recognize standardized acute and chronic severity classifications. The majority of children with asthma who presented to the EDs were classified as having mild acute severity and mild intermittent chronic disease.

With respect to ED utilization, the study demonstrated that that >58% presenting to the EDs were classified as having mild intermittent asthma when it had been anticipated that children with persistent asthma would be more likely to seek ED care. Many of these patients may have been able to be managed by a PCP, but >63% of patients failed to contact their PCP before arrival in the ED. Although the specific reasons for this failure were not fully explored, it was recognized that there might be multiple contributing factors. Access to a PCP might have been influenced in that more than 32% of the children presenting with asthma were uninsured. Those children with insurance were more likely to have called their PCP because they were more likely to have had a PCP to contact. Additional factors noted in this source from other studies that may influence a parent's decision not to contact a PCP:

- The lack of a written asthma action plan
- The advice from the PCP may not have been fully consistent with National Asthma Education and Prevention Program (NAEPP) guidelines
- <16% of PCPs could correctly categorize chronic asthma severity when tested
- Although most physicians were aware of the NAEPP guidelines they were unfamiliar with their specific recommendations or how to implement them.

The investigation of why families would choose not to contact their PCP first was outside the scope of this study, but ease of access (beyond insurance) may have been an additional determinant for why patients chose ED care over PCP care. Many of these patients may have been able to be managed by a PCP if access to care was possible and if such care increased asthma self-management knowledge and access to physician consultation.

McNally, A. J., Frampton, C., Garrett, J., & Pattemore, P. (2004). Application of asthma action plans to childhood asthma: national survey repeated. *The New Zealand Medical Journal, 117* (1196), 932.

Study conducted to review prescription of inhaled corticosteroid dosing. Written action plan was secondary. There has also been a decline in the proportion of asthmatic children receiving a written asthma action plan, and this is inconsistent with recommendations contained in consensus document

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Milnes, L., & Callery, P. (2003). The adaptation of written self-management plans for children with asthma. *Journal of Advanced Nursing , 41* (5), 444-453.

Study conducted to develop criteria for adaptation of asthma self-management in school-aged children. It was concluded that although care providers agree that asthma self-management plans should be adapted for children, there is little consistency in this adaptation. Most plans were not individualized. There is a need for further study to make plans more child focused.

Multi-colored Simplified Asthma Guidelines Reminder. Children Years Of Age (MSAGR-FE)©. (2003, May). Retrieved April 6, 2012, from Texas Tech University Health Services Center: www.ttuhsc.edu/fostersom/asthma/documents/msagrfe__may08.pdf

Multi-Colored Simplified Asthma Guideline Reminder (MSAGR): this is a user-friendly single-sheet asthma tool designed for clinicians to use in primary care settings.

National Asthma Education and Prevention Program. Journal of Allergy & Clinical Immunology. 2002 Nov;110(5 Suppl):S183-91.

In the opinion of the Expert Panel of the National Asthma Education and Prevention Program (NAEPP), the use of written asthma action plans is recommended. In a systematic review of the evidence, seven studies were reviewed to compare the use of asthma action plans to medical management alone. Five trials documented no diffferences in outcomes and two trials noted significant benefit especially with respect to reducing emergency room visits. All seven studies had limitations. The overall data was insufficient to support or refute advantages of using asthma action plans when compared with medical management alone.

National Center for Heart Lung and Blood Institute. (2007). *National Asthma Education and Prevention Program Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma Full Report.* United States Department of Health and Human Services. Retrieved April 6, 2012, from http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf

NHLBI Guidelines National Institutes of Health (NIH) guidelines were developed in 1992 and revised in 1997, 2002, and 2007 to optimize asthma management at multiple points of care, including primary care settings, EDs, and inpatient hospitalizations. The guidelines involve clinical assessment, objective measures of episode severity, appropriate and timely treatment, asthma education with use of preventative medications, and appropriate follow-up.

A summary of recommended key clinical activities for the 2007 NHLBI guidelines are presented in the table below:

Clinical Issue	Key Clinical Activities
Diagnosis	
	Establish asthma diagnosis.
Four Components of Care	
1. Assessment and Monitoring	• Assess asthma severity to initiate therapy. • Assess asthma control to monitor and adjust therapy. • Schedule follow-up care.
2. Education	• Provide self-management education. • Develop a written asthma action plan in partnership with patient. • Integrate education into all points of care where health professionals interact with patients.
3. Control Environmental Factors and Comorbid conditions	• Recommend measures to control exposures to allergens and pollutants or irritants that make and asthma worse. • Treat comorbid conditions.
4. Medications	• Select medication and delivery devices to meet patient's needs and circumstances.
Stepwise Approach	
General Principles for All Age Groups	• Incorporate four components of care. • Initiate therapy based on asthma severity. • Adjust therapy based on asthma control.
Ages 0–4 Years	• Consider daily long-term control therapy. • Monitor response closely, and adjust treatment.
Ages 5–11 Years	• Involve child in developing a written asthma action plan. • Promote physical activity. • Monitor for disease progression and loss of lung growth.
Ages 12 and Older	• Involve youths in developing written asthma action plan. • Promote physical activity. • Assess possible benefit of treatment in older patients. • Adjust medications to address coexisting medical conditions common among older patients.
Exercise-Induced Bronchospasm (EIB)	• Prevent EIB
Pregnancy	• Maintain asthma control through pregnancy.
Surgery	• Reduce risks for complications during and after surgery
Manage Exacerbations	

Clinical Issue	Key Clinical Activities
Home Management	• Incorporate four components of care. • Develop a written asthma action plan.
Management in the Urgent or Emergency Care Setting	• Assess severity. • Treat to relieve hypoxemia and airflow obstruction; reduce airway inflammation. • Monitor response. • Discharge with medication and patient education

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People with asthma can get H1N1 flu shots in nationwide trial of vaccine. (2009, October). Retrieved from Washington University in St. Louis: http://publichealth.wustl.edu/news/newsroom/Pages/H1N1flushot.aspx

On-line notice of a clinical trial conducted in 2009 at various sites across the United States. Study was conducted in asthma patients to test amount of antibody built up in blood against H1N1 virus following vaccinations.

Public Release. (2012, April 3). Retrieved April 7, 2012, from EurekaAlert!: http://www.eurekalert.org/pub_releases/2012-04/choe-cia040212.php

On-line notice of implementation of a new medical directive at the Children's Hospital of Eastern Ontario. A treatment option available on arrival to the Emergency Department allows nurses to administer an oral steroid treatment, which should reduce wait time and improve patient care.

Sin, D. D., Bell, N. R., & Man, S. F. (2004). Effects of Increased Primary Care Access on Process of Care and Health Outcomes among Patients with Asthma Who Frequent Emergency Departments. *The American Journal of Medicine , 117* (7), 479-483.

Study conducted to determine the effectiveness of a health professional– based intervention on improving process of care and outcomes among asthmatic patients seen in the emergency department. The study comprised an enhanced care process in which a study coordinator offered to make the follow-up appointment directly with the patient's physician. The findings suggested that this intervention did increase the rates of follow-up visits by asthmatic patients after emergency discharge. The increase in the frequency of follow-up visits was associated with a statistically significant and clinically meaningful improvement in health-related quality of life. The patients assigned to enhanced care were more likely to have written action plans and peak expiratory flow meters for their asthma at 6 months of follow-up. Unfortunately the improvements in the process of care disappeared by 12 months of follow-up, suggesting that the beneficial effects of this intervention are time limited and that further reinforcement of care patterns would be needed to maintain sustained outcomes.

Stanley, R. M., Teach, S. J., Mann, N. C., Alpern, E. R., Gerardi, M. J., Mahajan, P. V., et al. (2007). Variation in Ancillary Testing among Pediatric Asthma Patients Seen in Emergency Departments. *Academic Emergency Medicine , 14* (6), 532-538.

It is recognized that variation in the management of acute pediatric asthma within emergency departments is largely unexplored. A study was conducted to investigate ancillary testing for patients with asthma and to determine if there was an association between the patient, physician, and hospital characteristics. The study consisted of a retrospective chart review of patients seen in 25 emergency departments of a Pediatric Emergency Care Applied Research Network. The ancillary tests analyzed were chest radiographs and selected blood tests. There were 734 patients with acute exacerbations of asthma. 302 patients had ancillary testing; 198 had chest radiographs, 104 had blood tests. Chest radiographs were prevalent in patients with fever. Less blood testing correlated with physician subspecialty training in pediatric emergency medicine, patients treated at children's hospitals, higher patient oxygen saturation, and patient disposition to home. It was concluded that efforts to reduce chest radiographs should target the management of febrile patients with asthma, whereas efforts to reduce blood testing should target providers without subspecialty training in pediatric emergency medicine and patients treated in non-children's hospitals.

Ting, S. (2004). Multi-colored simplified asthma guideline reminder: why pragmatic asthma tools are needed in real-world practice. *Clinical Reviews in Allergy and Immunology , 27* (2), 133-145.

The National Asthma Educational and Preventive Program (NAEPP) and Global Initiative for Asthma (GINA) are evidence-based guidelines that focus on monitoring asthma severity, identifying triggers, providing optimal pharmacotherapy, and instituting patient education. The author noted that numerous studies demonstrated primary care physicians (PCPs) do not consistently utilize the NAEPP and GINA in practice. PCPs are unable to identify the 4 classes of asthma, FEV-1/PEFR value, PEFR variability, and step therapy based upon asthma severity. Reasons cited by PCPs for poor adherence to the guidelines include:

- Inability to recall asthma classifications and step therapy in real-world busy practice.
- Limited knowledge of various brands and exact doses of inhaled corticosteroids.
- Failure to explore triggers.
- Insufficient time/resources to educate the patient, teach inhaler techniques, or provide an asthma action plan.

This review discussed the Multi-Colored Simplified Asthma Guideline Reminder (MSAGR), the first user-friendly single-sheet asthma tool designed for clinicians. There was general acceptance of MSAGR (more than 1 million copies requested by clinicians globally). A published study demonstrated an overwhelming number of physicians strongly agreed that the tool helped them to recall classification of asthma severity, address triggers and to implement step therapy. After implementation of the tool, one hospital in a targeted community realized a 22.46% reduction in emergency room visits and a 26.89% reduction in hospital admissions.

Toelle, B., & Ram, F. (2002). Written indivdualized managment plans for asthma in children and adults. *Cochrane Database Sys Rev.* , (3):CD002171.

Comprehensive care that includes asthma education, a written self-management plan, and regular evaluation has been shown to improve asthma outcomes. This was a Cochrane review

of randomized controlled trials (RCTs) in patients with asthma. The objective of the review was to determine whether the provision of a written asthma self-management plan increased adherence and improved outcomes. Seven trials were reviewed. There was no consistent evidence that written plans produced better patient outcomes than no written plan. It was determined that the available trials were too small and too few and that results were inconsistent to form any firm conclusions as to the contribution of written self management asthma plans.

Trovato, J. (2009, May 5). *When To See an Asthma Specialist: Are You Getting the Care You Need?* Retrieved from http://www.jacqueline-trovato.suite101.com

On-line resource providing tips to the asthma patient with respect to when to seek care from an asthma specialist.

Volpe, D. I., Smith, M. F., & Sultan, K. (2011). Managing pediatric asthma exacerbations in the ED. *American Journal of Nursing , 111* (2), 48-53.

Children with asthma often present to the emergency department (ED) due to poor home control. Factors contributing to the high frequency of ED visits:

- Children don't have a primary care provider.
- Patients who have primary care providers do not follow up with them as advised by the ED.
- Families with a primary care provider may miss appointments.
- If primary care providers aren't informed that their patient has been seen in the ED, they can't provide follow-up care.

There are a number of practice guidelines and educational resources available to guide clinicians in the emergency management of asthma. Evidence-based guidelines cover the spectrum of emergency care, including the taking of a focused history, targeted assessment criteria, treatment, and discharge teaching. An essential area in asthma management is patient and family education.

ED clinicians have an important role in the care of children with asthma. They often treat families who don't have a consistent relationship with a primary care provider. It is essential that all members of the pediatric ED health care team be informed, educated, and updated on the current asthma treatment guidelines to ensure best practice and high quality outcomes.

Watts, B. (2009). Outpatient management of asthma in children age 5–11 years: Guidelines for practice. *Journal of the American Academy of Nurse Practitioners , 21*, 261-269.

This article focused on the importance of increasing awareness among nurse practitioners (NPs) regarding diagnostic and treatment guidelines for asthma for the 5–11 year age group updated by the National Asthma Education Prevention Program-Expert Panel 3 (NAEPP-EPR3). The diagnostic process was noted citing the importance of good history taking, the actual physical exam, spirometry and differential diagnoses. The NAEPP-EPR3 focuses on:

- Control of environmental factors and comorbidities
- Classification of severity and assessment of control
- Pharmacologic interventions
- Safety concerns

- Education

As a primary care provider to children age 5–11 years, the NP has an opportunity and duty to diminish the impact of asthma. Despite national guidelines many children with asthma continue to be undiagnosed or inadequately controlled. Improved control of asthma in accordance with the guidelines can result in decreased school absences, fewer urgent and emergency visits, decreased risk of exacerbations requiring systemic corticosteroids, and improved physical activity. The NP can be the catalyst for an enhanced understanding of the disease process and the safety and efficacy of available treatment.

Wechsler, M. E. (2009). Managing asthma in primary care: putting new guideline recommendations into context. *Mayo Clinic Proceedings , 84* (8), 707-717.

Review intended to assist primary care physicians in improving asthma control among their patients. Evidence demonstrates that asthma control is inadequate for a wide variety of reasons, both physician-related and patient-related. Since many patients with asthma are treated in the primary care setting, the primary care physician is crucial to recognizing poorly controlled asthma and to improving asthma management for these patients.

Previous guidelines were not adequately followed and did not lead to acceptable levels of asthma control. Early guidelines first introduced the stepwise approach to asthma therapy. Although useful, this approach had limitations, and there was a need to more clearly address the fluctuating severity of asthma symptoms over time. The 2007 National Asthma Education and Prevention Program (NAEPP) guidelines for the diagnosis and management of asthma (the Expert Panel Report 3[EPR3]), shifted the focus to ongoing assessment of disease control with the goal of improving the management of asthma over time. A key modification in the EPR3 guidelines is the emphasis on distinguishing between asthma severity. The updated guidelines also added a distinction between the domains of current impairment and future risk.

Regarding medication management, changes in the EPR3 guidelines include separate recommendations for 3 age groups of patients (children aged birth to 4 years, children aged 5 to 11 years, or patients aged 12 years or older) and the expansion of treatment steps from 4 to 6. The role of inhaled corticosteroids (ICSs) continues to be supported.

In accordance with the updated guidelines, severity and control should be assessed separately, but both are classified on the basis of the domains of current impairment and future risk. After disease severity has been assigned, treatment can be initiated at the recommended step. One of the obstacles of asthma management is that both patients and physicians tend to underestimate the severity of symptoms or overestimate the patient's level of disease control.

Referral to a specialist should be considered for any patient whose asthma is difficult to control. The asthma guidelines recommend that primary care physicians consider referral for patients who have experienced more than 2 oral corticosteroid bursts per year or a recent exacerbation requiring hospitalization, those who required therapy at step 4 or higher to achieve adequate asthma control, or those for whom immunotherapy is being considered.

Patients with asthma should be educated not to accept a certain level of symptoms or activity limitations as an inevitable consequence of asthma. The updated guidelines emphasize the importance of assessing, achieving, and continually monitoring asthma control by focusing on the key domains of impairment and risk.

Yawn, B. P., Enright, P. L., Lemanske, R. F., Israel, E., Pace, W., Wollan, P., et al. (2007). *Spirometry Can Be Done in Family Physicians' Offices and Alters Clinical Decisions in Management of Asthma and COPD.* Retrieved March 12, 2012, from American College of Chest Physicians: http://www.chestjournal.chestpubs.org

Study conducted in 12 community-based family medicine practices scattered through-out the United States to assess the technical adequacy, accuracy of interpretation, and impact of office spirometry in the management of previously diagnosed COPD or asthma. 368 tests were completed in 6 months for patients >7 years old. 71% were technically adequate for interpretation. Family physician and pulmonary expert interpretations were concordant in 76% of completed tests. Spirometry was followed by guideline recommended changes in treatment (both pharmacologic and nonpharmacologic) in 48% of the patients. Concordance between family physician and expert interpretations of spirometry results was higher in those patients with asthma compared to those with COPD.

IV. Adequacy of PCP Practice Site to Handle Acute Exacerbations

Summary

There are a number of factors to consider when evaluating the adequacy of PCP practice to provide appropriate treatment for children with asthma. Providers are increasingly challenged by financial and time constraints, making comprehensive care more difficult to deliver, particularly for children with chronic illnesses. Although a number of initiatives are underway to improve asthma care delivery in the primary care office, it is equally important to note that the patients/families also play a role in asthma care.

Several studies have documented poor physician adherence to the guidelines for asthma care. An office visit provides the opportunity to assess symptoms, establish treatment goals, prescribe appropriate medications, discuss environmental factors, and deliver education. As noted above, steps taken to augment physician knowledge of the clinical practice guidelines for asthma management enhances practice.

Children with asthma often present to the emergency department (ED) due to poor home control. Factors contributing to the high frequency of ED visits:

- Children don't have a primary care provider.
- Patients who have primary care providers do not follow up with them as advised.
- Families with a primary care provider may miss appointments.
- If primary care providers aren't informed that their patient has been seen in the ED, they can't provide follow-up care. In one study (included in this review) of 88 pediatric patients seen in the ED, there was no evidence of any type of communication between the medical services for any of the patients studied.
- The lack of a written asthma action plan

With respect to spirometry testing in the primary care setting, the results were variable. One study demonstrated concordance between family physicians and expert interpretations of spirometry results. Another concluded that the use of spirometry in primary care settings for children with asthma does not conform to national guidelines. Improved adherence to guidelines would necessitate educational initiatives to address deficiencies in spirometry interpretation and overcoming other barriers.

A number of sources in this literature review cited the benefits of a multidisciplinary team approach: One study focused on the interaction between the PCP and specialist at the offset in order to facilitate utilization of the guidelines in a standardized manner. The study also made note of a network of providers including physicians, nurses, school personnel, pharmacists and coaches who have collaborated in the care of asthmatic children and their families. Shared protocols in addition to shared clinical data enhanced improved self-management. Working with a PCP who was part of a larger network of care practitioners improved patient trust.

Bibliography

As noted above, bibliography included under Adequacy of Management of Asthma.

V: The Connectedness of Care in the Primary Care and ED Setting

Summary

Follow up visits after emergency room (ER) care are most effective when risk factors for noncompliance are identified prior to discharge, parental health beliefs are examined, and follow up resources are examined with the healthcare team. A gap is identified in the literature regarding actual compliance with follow up visits. Effective interventions to increase adherence was subsequently examined. When appointments were made for the patient, compliance was 69%, when a plan for the appointment was made, compliance was 60%, and those left on their own to make a follow up appointment had a mere 25.2 % compliance rate of follow up.

The literature search identified a difference in the utilization of care in both the Emergency Department (ED) and primary care setting that changed following an ED visit for asthma. Education in the emergency room has profound benefits for children, and improved outcomes such as lung function, decreased school absenteeism, and visits to the emergency department. However, education for children who have received emergency department care for asthma has not been effective in the reduction of subsequent emergency department visits, hospitalizations, or unscheduled doctor visits.

It was determined that lack of a utilization of a primary care provider post emergency room treatment may contribute significantly to the high asthma morbidity and lack of resource utilization in children from low-income families.

Effective emergency room visits, and a decreased risk for exacerbation after visit is correlated with use of inhalers, and adherence with inhalers in pediatric asthmatic patients. Efficacy was determined for Inhaled Cortico Steroids (ICS), as they were prescribed and used 56% -86.8% of the time, and Beta Agonists Bronchodilators that were prescribed 17% - 94.9% of the time. It was also determined that ICS in high doses in the emergency department demonstrated a reduction of hospital admission rates.

Lack of a Primary Care Provider (PCP) prior to an emergency room visit contributes only slightly to asthma morbidity. However, lack of PCP and lack of resources, leads to a greater use of the ED. The quality of the PCP care has been determined to affect readmission to the emergency room as well. In one survey 4% of the care providers used did not follow international guidelines. Use of a quality program or an organized National Asthma Education and Prevention Program along with the use of a PCP has been found to decrease ED visits by 35%.

According to studies in this literature review, the utilization of international guidelines directing physician decision making regarding recommendations to consult specialists are not consistently followed. A deficit in communication and information transfer was determined to occur at the time of hospital discharge (in this random population reviewed) and may adversely affect patient care. The rapid growing interest in care coordination together with the growth in hospitalist admission rates, and the development of specialty services, created further reason for investigation on the importance for hospital-based physicians and primary care physicians to communicate relevant patient information at hospital discharge.

Bibliography

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Emergency care was evaluated retrospectively. The following weak points were established:

- Failure to determine the degree of severity
- Lack of specification of the details of the crises
- Scant asthma background history (maintenance care)
- Deficient recordings of respiratory frequency and peak flow

Study participants included diagnoses of broncospasm, bronchial asthma with broncospasm, asthma or bronchial hyperresponsiveness, and were 2-14 years of age.

- Treatment conditions at discharge:
- Treatment provided in the ED
- Treatment response in writing
- Treatment for home (treatment at discharge)

Brody, J.L., Annett, R.D., Scherer, D.G., Turner, C., and Dalen, J. (2009). Enrolling adolescents in asthma research: adolescent, parent, and physician influence in the decision making process. *Journal of Asthma, 46 (5),* 492-497.

The influence of physician recommendations on adolescent asthma patients is currently under researched. Adolescents with asthma were interviewed regarding communication, rapport, and perceived knowledge of their attending physician.

Burns,D., (2001). The management of exacerbations of acute asthma in primary care. *Nursing Times, 100 (6),* 48-50.

This article defines uncontrolled asthma as a drop in peak flow readings, which measures peak expiratory flow, and is considered a good guideline for assessment.

Not all patients have peak flow meters, and there is evidence that even if they do, they do not use them. Increase in report of symptoms may be a better source of information. However, there is evidence of asthmatic patients having a poor perception of Dyspnea. This article reviewed 6 TS/SIGN as a guideline to assist identification relating to uncontrolled asthma.

Asthma patients who use this technique can begin rescue action and manage symptoms at home with bronchodilators.

After uncontrolled exacerbation that indicates hospital admission, guidelines suggest that patient see their own primary care taker within two working days.

Bush, A., and Sejal, S. (2010). Management of severe asthma in children. *The Lancet, 376, (9743*) 814 - 825,.

This review focused on children with problematic severe asthma (that does not respond to treatment). There is substantial morbidity with this group and the evidence base for management is lacking. There are 4 domains of severity in children with asthma:

1. Level of current prescribed treatment
2. Level of current baseline control of asthma over at least the preceding month
3. Immediate past burden of asthma exacerbations, including number and severity
4. Future risk of complications, including: risk of failure of normal postnatal airway growth; risk of future loss of asthma control; risk of future exacerbations; risk of phenotype change from episodic, viral, to multi-trigger

The review noted that referrals to specialists are usually prompted by symptoms, safety concerns with respect to medication, and risk subsequent to admission to intensive care. It is important to evaluate whether the asthma is true "severe therapy-resistant asthma" as opposed to being: not asthma at all, mild asthma exacerbated by co-morbidities, or difficult to treat due to poor adherence or poor inhalation techniques.

There is a need for further study on new approaches to management of children with severe asthma. The current best approach, thorough multidisciplinary assessment should produce results with conventional treatments.

Cavazos, G (2006). Asthma in emergency department. Guidelines, Physicians and Patients. *Revista Alergia Mexico, 53, (4*), 136-43.

Study conducted to determine causes of high morbidity and mortality due to bronchial asthma. Retrospective study of 152 patients (88 pediatrics) seen by emergency medical services 234 times during one calendar year. Four variables investigated:

1. Number of patients who were diagnosed with bronchial asthma
2. Number of patients prescribed regular treatment with inhaled corticosteroids
3. Number of patients compliant with regular treatment with inhaled corticosteroids
4. The existence of collaboration among the different levels of medical services (emergency service, outpatient service and asthma specialists)

Results (of the 88 pediatric patients):

- Only one had been diagnosed with asthma in accordance with international guidelines.
- Only 41 had been prescribed a preventive anti-inflammatory treatment in a regular manner with inhaled corticosteroids.
- 23 demonstrated good compliance to inhaled corticosteroids.
- 15 used B-2 agonist bronchodilators for treatment.
- There was no evidence of any type of communication between the medical services for any of the patients studied.

There is a lack of knowledge with respect to the guidelines for treatment of asthma among emergency physicians. This lack of knowledge contributes to treatment failures and patient confusion. Strategies for implementation of international guidelines for the treatment of asthma

have failed. Steps must be undertaken to facilitate compliance with evidence-based guidelines in order to reduce worldwide morbidity and mortality.

Children's' Health Council (2002). Few children in HUSKY A received care after an emergency visit or hospitalization for asthma. Retrieved from www.childrenshealthcouncil.org on March 28th, 2012.

HUSKY An enrollment data of children who were seen for emergency care or hospitalized for treatment of asthma with a discharge ICD-9 codes of 493.0-493.9 were enrolled into the trial. Health carriers were: BlueCare, Perferred One, Community Health Network, and Health Net

The percentage of children who had ambulatory care follow up after an emergency visit or discharge was determined. This was to establish the percentage of children who were at the greatest risk for no follow, and determine with relative effectiveness of health plans and their profile networks, the odds of having had follow up by 2 weeks were calculated while controlling for age, gender, race, ethnicity, primary language residence and health plan.

20% of the children with visits in Emergency Room had a follow up appointment within two weeks by office or clinic.

41% of the children with Hospitalization had a follow up appointment within two weeks by office or clinic.

Clark, N, Cabana, M, Nan, B, Gong, M., Slish, K.K., Birk, N.A>, and Kaciroti, N. (2008). The clinician-patient partnership paradigm: Outcomes associated with physician communication behavior. *Clinical Pediatrics, 47 (1*), 49-59.

Physician communication behaviors such as careful listening, inquiries during assessment about at home management, nonverbal attention interactive conversation, setting and tailoring goals, and theraputetic plans are associated with patient outcomes. The effective clinical communication contributes to the actual health goal, which ultimately will lead to improved health outcomes.
Communication plans that improve health care use were identified as those that reduce worries, and left the patient feeling as though the clinician has attended to their health concerns . Discussing the length of the plan, laying out terms the patient can understand with time lines and attainable goals make it clear to the patient and leads to better compliance in treatment, and eventually both know that control is being obtained.

Clouter, M.M., Hall, C.B., Wakefield, D.B., and Balit. (2005). Use of asthma guidelines by primary care providers to reduce hospitalizations and emergency department visits in poor minority, urban children. *The Journal of Pediatrics, 146,* 591-597.

The objective of the study was to determine whether an organized citywide asthma management plan delivered by PCP increased adherence to the National Asthma Education and Prevention Program, Asthma Guidelines and where this decreased the need for medical services in low income minority children.

“Easy Breathing” was a program used to ensure PCP adherence to guidelines. Those children experienced a 35% decrease in ED visits and a 19% decrease in outpatient visits.

Easy Breathing focuses on four elements of care:

- Diagnosing asthma
- Determining asthma severity
- Prescribing therapy appropriate for the severity
- Developing a written asthma treatment plan given to the family.

Courtney, A.U., McCarter, D.F., and Pollart, S.M.. (2005). Childhood asthma: Treatment update. *American Family Physician, 71,* 1959-1969.

Inhaled corticosteroids in high doses in the emergency department demonstrated a reduction of hospital admission rates in patient with acute asthma.

Children whose asthma is inadequately controlled with standard dosages of inhaled corticosteroids have not been shown to benefit from the addition of a long-acting beta2 agonist or from an increase in the dosage of inhaled corticosteroids.

Education in the emergency room has benefits for children and improves similar outcomes such as improving lung function and decreased school absenteeism and visits to the emergency department.

However, education for children who have received emergency department care for asthma does not reduce subsequent emergency department care, hospitalizations, or unscheduled doctor visits.

Diedhiou, A., Probst, J.C., Hardin, J.W., Martin, A.B., Xirasagar, S. (2010). Relationship between presence of a reported medical home and emergency department use among children with asthma. *Medical Care Research and Review, 67,* 450-475.

This study reviewed the National Survey of Children with Special Health Care Needs to review the relationship between the use of the medical home and the need for emergency care. Results indicated that receiving primary care in a medical home was associated with fewer emergency room (ER or ED) visits. The medical home is one in which parents share responsibility for ensuring that children have access to needed services that may improve the child and family outcome for children with asthma.

The study examined the number of ED visits, potentially preventable outcomes, ED admissions and quality of ambulatory care. Children who lived in a medical home, or home in which shared responsibility was present, along with a supported demographics such as two parent home with uninterrupted insurance coverage, had 7% fewer ED visits.

This study also confirmed the understanding that children in poor, or near poor families are more likely to have uncontrolled asthma and rely on emergency visits as their usual source of care, indicating a lack of physician support to manage asthma symptoms.

The study suggested that one intervention for those utilizing only emergency services is to include ED physicians in a partnership with efforts to increase non emergency care such as

ambulatory care centers, and referral of those children to local primary care providers where they can access the services needed.

Galvan, M. (2006). Asthma in emergency department. Guidelines, physicians and patients. Revista *Alergia Mexico, 53 (4),* 136-143.

Goal was to examine why pediatric asthmatic patients are seeking care in the emergency room. Findings: only one child was diagnosed with mild persistent asthma. The remainder of the patients struggled with multiple other diagnoses by different pediatricians in outpatient consultation and in the ER services such as respiratory hyper reactivity, or bronchial hyper reactivity, acute bronchitis, bronchiolitis, and bronchospasm.

Some of the patients were told they had asthma, but not according to the international guidelines. Of the pediatric patients reviewed, they had been prescribed a preventative anti inflammatory treatment with inhaled corticosteroids; only 56% of the patients had good compliance. It was found that only 26% of the pediatric patients had regular treatment with inhaled corticosteroids as recommended by the international guidelines, 17% of the patients with asthma used only beta agonist bronchodilators for treatment.

Primary care physicians were surveyed after the collection, 4% stated they did not know about the international guidelines and four stated they know about the guidelines, but do not use them as they are too long and complex.

Many problems were identified with this population.

1. Use of beta agnostic exclusively to treat asthma has been associated with an increase in mobility and mortality in asthmatic patients.
2. Physicians were less likely to prescribe corticosteroids
    a. They are unfamiliar with guideline recommended therapy
        i. The guidelines are long and complex
        ii. The supportive staff is not familiar with the guideline
        iii. There is not enough education material associated with the guideline.
    b. They have sub diagnoses or sub estimation of the clinical state of the asthmatic patients.
    c. The physicians have cortico-phobia, concern with affects of steroid, growth rates, in children, or oral mycosis.

These were all considered primary care insufficiencies that lead to an increase in emergency room visits for asthmatic children in exacerbation.

Galant, S.P., and Nickerson, B.(2010). Lung function measurement in the assessment of childhood asthma: recent important developments. *Current Opinion of Allergy and Clinical Immunology, 10*; 140-154.

The new NAEPP guidelines add spirometery criteria, the FEV / FEC ratio to assess asthma severity. It is thought to be the most useful because it is objective and reproducible, has been used in clinical trials and is associated with improvement in symptoms, health related quality of life, rescue medication and healthcare utilization.

It has been reported that those children with FEV less than 80% predicted were 1.8 times more likely to experience more symptoms and sever exacerbations associated with emergency room visits.

Problem with this is when emergency visit records are retrospectively reviewed from primary care office, they have normal FEV, so that majority of asthmatic attached occurred in children with normal FEV, casting doubt on the adequacy of this measurement use alone.

Greene, J., Yedida, M.J., (2005). Provider behaviors contributing to patient self management of chronic illness among underserved populations. Journal of Care for the Poor and Underserved, 16, 808-824.

This research explores the provider support necessary for effective self management on patient performance of self-care activities, among underserved populations. Parents of pediatric patient primarily low income with diabetes's or asthma were researched. The study reveals that health care providers play an important role in promoting patient self management when they have a chronic illness.
Measures that increased self management included promoting partnership with physicians, involving them in the treatment plan, encouraging them to learn about their chronic illness, assisting them in lifestyle or environment changes, spending time with them and being available during a crises were all behaviors that physicians' exhibited in which an impact was found in the patient's self management.

Kripalani, S., LeFevre, F., Phillips, C.O., Williams, M.V., Basaviah, P., and Baker, D. (2007). Deficits in communication and information transfer between hospital-based and primary care physicians: Implications for patient safety and continuity of care. *JAMA, 297 (8),* 831-842.

This article was an observational study investigating communication with providers, and information transfer to next care provider at hospital discharge (n=55) and controlled studies evaluating the efficacy of interventions that were used to improve information transfer (n=18). It was determined that a deficit in communication and information transfer does indeed occur at hospital discharge in this random population, and may adversely affect patient care.

<u>Interventions to assist with physician to physician communication include:</u>
Computer- generated summaries
Standardized formats
Facilitation of communication in a more timely transfer
Pertinent patient information to primary care physicians
Discharge summaries more consistently available during follow-up care.

The rapid growing interest in care coordination with the rapid growth in hospitalist admission rates, and development of specialty services, medicine, it has become increasingly important for hospital-based physicians and primary care physicians to communicate relevant patient information at hospital discharge.

Leickly, F.E, Wade, S.L., Crain, E., Kruszon-Moran, D., Wright, E.C., and Evans, R. (1998). Self-reported adherence, management behavior, and barriers to care after an emergency department visit by inner city children with asthma. *Pediatrics, 10,* 1-8.

The parental report of medications prescribed at the ED and the information on the abstracted ED report agreed 94.9% of the time for the b-agonists, 86.8% for steroids, and 69.4% for Cromolyn.

Appointments for follow-up care were kept by 69% of those given an appointment in the ED, by an estimated 60.0% of those who were told specifically to call for an appointment, and by an estimated 25.2% of those who were neither given an appointment nor told specifically to make one.

Mansour, M (2009). How do we support follow up with the primary care provider after an emergency department visit for asthma? *Pediatrics, 124,* 1206.

This study examined barriers to follow in with outpatient healthcare after emergency room visit. The study is unique in that it addressed parental health beliefs regarding patient follow-up with a PCP.

Results were organized into table and included:

<u>What are NOT barriers for Parents to health care follow up?</u>
- Access to a provider,
- Financial capabilities

<u>Barriers of Parents to healthcare follow up:</u>
- Health beliefs
- Readiness to change
- Confidence
- Self Assessment of barrier
- Knowledge of resources
- Trust of relationship with care provider

<u>Barriers of Healthcare Personal to get Parents to healthcare follow up:</u>
- Motivational interviewing techniques to identify issues that affect health seeking behaviors
- Knowledge of resources
- Need for care manager
- Health beliefs of the providers and skepticism
- Providers believe of concept of emergency visit necessities
- Current payment system

Mellon, M., and Parasuraman, B. (2004). Asthma: Improving management to reduce cost of care. *Journal of Managed Care Pharmacology, 10(2),* 130-141.

Lack of a primary care provider may contribute significantly to the high asthma morbidity and resource utilization in children from low-income families, who may be more likely to use the emergency department as a source of primary care.

Moseley, K.L. and Hudson, E.J. (2009). Steroid inhaler adherence, flu vaccine receipt, and race: associations with the quality of the parent-physician relationship for asthmatic children. *Journal of the National Medical Association, 101(5),* 407-413.

The object of the study was to examine the association between parent's adherence to administering their child's steroid inhaler, influenza vaccine receipt and parental perceptions of the primary care experience.
Results showed that children with inhaler-adherent parents were more likely to be immunized, black parents were less adherent to steroid use, and white nonblack nonwhite children had lower vaccines rates.

Continuity of care was associated with better inhaler adherence. The study also examined interpersonal skills and parental trust in the physician, and minority parents of children gave lower ratings than white parents, to the child's physician and office on characteristics associated with inhaler adherence and immunization (flu vaccine). Adherence to inhaler therapy indicates management of asthma care such as receipt of influence vaccine. This information may help physicians predict those asthmatic patients who are at risk for exacerbations.

Patel, M.R., Coffman, J.M, Tseng, C.W., Clark, N.M., and Cabana, M.D. (2009). Physician Communication regarding cost when prescribing asthma medication to children. Clinical Pediatrics, 48 (5), 493-498.

Both Pediatricians and Family Practice Physicians were asked whether they asked families of asthmatic children if cost was a barrier to prescribing. This study summarized that only half of the physicians caring for patient with asthma asked a parent or care giver about mediation costs. This is especially disheartening when cost of medication has been identified as a barrier. Pediatricians were less likely to ask about cost when compared to Family Physicians.

The authors suggest that Family Practice Physicians might be more experienced and therefore have comfort in communicating with families in regards to insurance coverage as they may have dealt with adult populations who are at greater risk to be uninsured. The article discussed the possibilities of modifying pediatrician training to include communication skills, especially relating to sensitive issues.

As part of the comprehensive NHLBI guidelines, all aspects of care, including cost, must be addressed to maintain medication adherence with asthma children to reduce incidence of exacerbation. Lack of communication with providers regarding this topic may contribute to non adherence to medication regimens and an overall reduction in outcomes.

Seid, M. (2008). Barriers to care and primary care for vulnerable children with asthma. *Pediatrics, 122, 994-1002.*

Data was collected randomly for problem solving skills training to reduce barriers to care for family of vulnerable children with asthma.
Asthma severity, financial, potential and realized access along with barrier to care were examined.
The P3C measures perceptions of quality based on parent's reports of their experience, rather than ratings of satisfaction with those experiences. This was designed to measure parents' perceptions of experience in receiving primary care, rather than the quality of a particular provider of primary care.

This was done to compare the results to the IOM definition of quality primary care.
There was also consideration of the large proportion of uninsured children and children without regular source of care, who received care at the emergency department or community clinic.

Quality primary care broken into categories

1. Longitudinal continuity is defined as The parent's report of the length of time they have been bringing their children to a regular place or physician
2. Access to care is defined as the parent's report of timely and convenient access to care for their children.
3. Communication is defined as the parent's report of how well the physician listens and explains during their interactions.
4. Contextual knowledge is defined as the parent's report that the physician knows his or her values and preferences about medical care issues, clearly understanding his or her children health needs and knows the children medical history.
5. Comprehensiveness is defined as the parent's report of the extent to which a regular place and or doctor proves care for acute and chronic problems and preventive services.
6. Coordination of care is defined as the parent support of the physician knowledge of other visits and visit to specialists as well as follow up monitoring of problems though subsequent visits of telephone calls.

Teach, S.J., Crant, E.F, Quint, D.M., Hylan, M.L. and Joseph, G. (2006). Improved asthma outcomes in a high-morbidity pediatric population: results of an emergency department-based randomized clinical trial. *Archives of Pediatric Adolescent Medicine, 160*, 535-541.

Convenience sample of 488 patients aged 12 months to 17 years, inclusive, with prior physician diagnosed asthma and 1 or more other unscheduled visits in the previous 6 months and/or 1 or more hospitalizations in the prior 12 months.

Focus of intervention tested: follow-up clinic visit focusing on 3 domains: asthma self-monitoring and management, environmental modification and trigger control, and linkages and referrals to ongoing care.

The results supported that a single follow up visit to a comprehensive ED-based asthma clinic resulted in significant and clinically relevant improvements in care and outcomes in a high-morbidity pediatric populations.

This focused visit was designed on previous work that reviewed motivation for behavior changes such as weight loss. A high rate of clinic attendance suggested that participants were motivated to improve care, and the thought was that adherence to home regimen would be followed greater.

This intervention strengthened the family relationship with the PCP, but did not achieve this objective. Providing the ED-based system for short asthma management has a negative effect in the relationship with the PCP (evidence of this was not provided in the study)

Wu, A.C., Smith, L, Bokhour, B., Hohman, k, Lieu, T.A. (2008). Racial/Ethical Variation in Parent Perceptions of Asthma. *Ambulatory Pediatrics, 8,* 89-97.

This study reviewed minority parents' perceptions of asthma and the care their children received, including interactions with providers and competing family priorities. The hypothesis tested was if minority parents, specifically of black, Latino and white children, had lower expectations for functioning with asthma, had more concerns about asthma, had any worse reports of interactions with providers, or more competing family priorities.

Evidence found that 91% of parents were "highly satisfied with communication with the providers. Parents felt their providers were knowledgeable of the specifics of their child's health and history. There was no significance in the differing responses among the different minority groups involved.

Yawn, B.P. (2011). The role of the primary care physician in helping adolescents and adult patients improve asthma control. *Mayo Clinic Proceedings, 86 (9*) 894-902.

Outcome related failures regarding children's asthma control, adherence to asthma therapies, desire to avoid regular reliance on medications and inappropriate high tolerance of asthma symptoms may be related to primary care physicians' lack of communication and management. Tools such as the Asthma Control Test, the Asthma Therapy Assessment Questionnaire, the Asthma Control Questionnaire, and the Asthma APGAR provide methods of gathering non crises information about asthma management.

Non adherence was directly correlated with forgetfulness in the adolescent asthmatic population. This puts this population at risk for poorly controlled asthma, leading to a higher risk of exacerbation and the need for emergency intervention. The primary care physician can educate, follow up and manage self management skills in the adolescent, which can increase not only adherence of medical regime, but also ensure identification and reduction of triggers. Utilizing the time available to discuss asthma when the child is not in distress is key to asses and manage uncontrolled asthma. This is of particular concern with asthmatic children who tend to avoid regular follow up appointments.

VI. Equity is a value in Asthma Care

Summary

The literature reviewed indicates a predictable difference in the processes of caring for children of minority populations thus representing an inequality in the structure of healthcare delivery. The availability of Emergency Department (ED) care, and the frequency of visits is relative to the adequacy of outpatient care, ambulatory care, disease severity, and hospital admission practices in the studies reviewed. Process structures around the education of families, specifically the correct identification of signs and symptoms of asthma exacerbation, increase unavoidable use of emergency service s in minority populations. This literature review examined a lack of contact with a child's physician accounting for 50% of ED visits, where as a lack of resources for prescription renewal accounted for 26% of ED visits, as well as the adequate delivery of medicine and proper use of a spacer device that was accessible accounted for 51% of ED admissions.

Outcome analysis in respect to predictable differences with imbalanced resources is reflective of the quality of the care in the ED for this pediatric asthmatic population. Monitoring health care with optimization of asthma management could reduce costly acute care services. People with uncontrolled asthma from minority groups have poor asthma outcomes, and more asthma related visits to the emergency room. Quality measurement regarding prescription refill for controller medications within a one year time period of the ED visit, and a ratio measurement of the number of asthma medications filled within a one year time period of the ED visit provides the community with information on predicting "at risk asthmatics", and allows for intervention to lower the odds of readmission to the emergency department.

Minority populations that were interviewed reported their experiences with ED personal and their exposure to the healthcare system. This resulted in an unclear answer as to why racial and socio-economic factors influence both asthma severity, and the rate of recurrent emergency room visits. Service and delivery issues are thought to be the barrier, however cultural influences on disease management, including symptom perception, and a lack of understanding disease self management, or the lack of caretaker management, is actually the better indication of an increased need for ED use.

Predictable differences are found in coordination of care that relates to a greater use of nonemergency ambulatory visits by non Hispanic black children. Low-income Latino families with young children with asthma lack the medical resources, or chose not to use, or are unable to use the medical resources necessary for good asthma control. Families with these combined risk conditions might warrant home health nursing services

The external physical and the social environment affecting pediatric asthmatic use of the ED is still under investigation. It has been determined that rural and urban areas have a great difference when comparing the identification of, and prevalence of, asthma triggers that correlate with increased ED use.

<u>Asthma triggers that were higher in rural areas included</u>:

- pesticide spraying of crops,
- waste/dump sites located in rural rather than urban areas
- bacterial endotoxins from farm animals,

- air pollution (ozone, indoor carbon monoxide, methane gases)

Asthma differences in Rural Children
- less likely to be sensitive to domestic pet dander (e.g., cats, dogs)
- more sensitive to farm animals (e.g., horse, cow, pig, storage mites)
- rural residences were significantly less likely to have both follow up office visit, and ED visit

Bibliography

Akinbami, L, J, Moorman, J.E., Garbe, P.L., and Sondik, E. (2008). Status of childhood asthma in United States 1980-2007. *Pediatrics, 123,* S131 2233C.

Historically in 1990, ambulatory visits fluctuated during the 1990s, while emergency department visits and hospitalization rates decreased slightly.
Higher asthma prevalence in older children 11-17 years old, bur the highest rates of asthma related health care use were among the youngest children (0-4 years).

Non-Hispanic black children with asthma had greater risks for emergency department visits and death, compared with non-Hispanic white children. Non emergency ambulatory visit care is lower for non Hispanic black children.

Trending data from the National Vital Statistics System and from 3 surveys conducted by the CDC National Center for health statistic that is the National health interview Survey, the National Ambulatory Medical Care Survey and the National Hospital Discharge Survey.
Prevalence noted that American Indian and Alaska Native decent were 1.3 times more likely and black children were 1.6 times more likely to have asthma than white children.
Asian children had the lowest prevalence, while Puerto Rican children were 2.4 times more likely to have current asthma than were non Hispanic white children. Mexican children had relatively low current asthma prevalence.
Hospitalized children: Black children had 2.6 times higher Emergency visits, and death rates 4.9 times higher than non Hispanic white children. Rates of hospitalization for black children were 2.0 times higher than those for white children.
Although overall rate of death from asthma in children decreased after 1999, the pattern was not found in black children, their deaths remained the same.
Through the first decade of life, boys have higher rates of emergency healthcare use and death. Very young children have equal use of emergency care, related to the variation in symptoms and small airway. Therefore there is an increase in the utilization of the ED and hospital services among the very young asthmatic children.
The rates of ED visits and hospitalizations are at least partially sensitive to the availability, quality, and continuity of ambulatory health care as well as disease severity, hospital admission practices, and inappropriate use of emergency services.

Babey, S.H., Hastert, T.A., Meng, Y., and Brown, R. (2007). Low income Californians bear unequal burden of asthma. *Health Policy Research Brief,* 1-8.

Improving access to healthcare in California for lower income households, will improve asthma management and to decrease reliance on costly emergency department visits and hospitalizations. There are many Californian children and adults with active asthma, an d11%

do not have any usual source of health care, which creates a barrier to receiving the continuity of care that is essential to controlling the disease. Among adults living with active asthmatics, living below the poverty line 24% are current smokers.

Berg, J., Wahlgren, D.R., Hofstetter, R., Meltzer, S.B., Meltzer,E.O., Matt, G.E., Martinez-Donate, A., and Howell, M.F. (2004). Latino children with asthma: rates and risks for medical care utilization. *Journal of Asthma, 41(2*), 147-157.

The purpose of the study was to examine if the previous trend of Latino families having a reported underutilization of health care services. As a part of a community trial with low income Latino families, this trial was designed to decrease environmental tobacco smoke (ETS) exposure in children with asthma, and reviewing their use of unscheduled medical care, emergency room and clinic. This report is an assessment of medical care use among San Diego, California Latino families with a child with asthma.

These findings indicate that low-income Latino families with young children with asthma lack the medical resources, or chose not to use the medical resources necessary for good asthma control. Quality and monitored health care with optimization of asthma management could reduce costly acute care services.

Urgent care use was more likely for younger children (7 and under), and for those whose caregiver had at least a high school education. The use of any service was similarly related to child's age and parent's education, and also to culture status (Spanish speaking language).

Not surprisingly, emergency department use was three times more likely for boys than girls, and over twice as likely for children of parents who had completed a high school education.

Many families reported living in substandard housing with many asthma triggers present. Although it is recognized that indoor and outdoor environmental allergens can exacerbate asthma symptoms, especially in young children, these families lack resources to substantially modify their environment.

Other variables such as environmental triggers and home conditions that would be expected to contribute to the requirements for medical care use in this sample also were not associated with higher use of unscheduled visits. New theories to support his are the possible explanation for these findings, which differs from those of previous studies is that families in the current study were recent immigrants who were reluctant to use medical services in the U.S.

Families with these combined risk conditions might warrant home health nursing services in order to obtain the needed primary care services and to reduce extraordinary risks, such as exposure to triggers such as ETS.

Butterfoss, F.D., Kelly, C., and Taylor-Fishwick, J.T. (2005). Planning that magnifies the community's voice: allies against asthma. *Health Education Behavior, 32*, 113.

Focus groups revealed inadequate asthma education, low income, lack of resources and consistent care, disparities in insurance coverage, and noncompliance with national asthma guidelines.

The Consortium for Infant and Child Health (CINCH) is a community partnership committed to a vision of Hampton Roads, Virginia, as a community distinguished by healthy children who are ready to learn.

The population for this study included:

- 60% White
- 36% are African American
- 4% includes Filipinos, Hispanics, Asians, and others

Of children younger than 6 years, 19% are below the poverty level (U.S. Bureau of the Census, 2000). The analysis involved isolating all cases of pediatric asthma using International Classification of Diseases (ICD) codes for primary and secondary diagnosis and grouping cases by zip code.

Results indicate that children were predominantly African American (84%), male (72%), and younger than 8 years (61%). In 65% of the sample, two to six visits to the ED occurred during the last 12 months, 50% of children were typically brought to the ED when they were having signs and symptoms of asthma (i.e., they did not contact their child's physician), 26% had run out of medication, and 51% did not have a spacer device at school. Involving community members early in needs assessment and planning helps to ensure that they implement the planned strategies.

Butz, A.M., Thompson, R.E., Tsoukleris, M.G., Donitha, M., Hsu, V, Mudd, K., Zukcerman, I.H., and Bollinger, M. I(2008). Seasonal Patterns of Controller and rescue medication dispensed in underserved children with asthma. *Journal of Asthma, 45*, 800-806.

The object of the study was to determine whether temporal trends exist for short acting beta agonist (SABA) or oral corticosteroids (OCS) and anti inflammation prescriptions refills in children.

Population of the study: Children were primarily African-American (89%), male (64%), and received Medicaid health insurance (82%), and were a mean age of 4.5 years (SD 2.1).

Eligible children had to report current nebulizer use and one or more emergency department visits or hospitalizations within the past 12 months. Summer months has lowest prescription fills, with a dramatic rise at the end of August, which had the highest. The month of December had maintenance use.

Predicting asthma medication needs prior to seasonal demand may increase adherence and symptoms management for underserved children. Use of an "asthma tune up" prior to seasonal peak theoretically can improve asthma control.

Bailey, E.J., Castes, C.J., Kruske, S.G., Morris, P.S., and Brown, N. and Chang, A.B. (2009). Culture-specific programs for children and adults from minority groups who have asthma (Review). *The Chochrane Collaboration, Issue 2.*

People with uncontrolled asthma from minority groups have poor asthma outcomes, and more asthma related visits to the Emergency room. Programs that intervene and educate and empower these minority groups have improved outcomes.

It is unclear why racial and socio-economic factors influence both asthma severity and rates of recurrent emergency room visits. Service and delivery issues are thought to be the barrier, however cultural influences on disease management include symptom perception, and understanding disease self management.

Cutuli, J.J., Herbers, J.E., Rindaldi, M., Masten, A.S. and Oberg, C.N. (2009). Asthma behavior in homeless four to seven year olds. *Pediatrics, 125*, 145-152.

Low income, urban ethnic minority children have higher rates of asthma, more severe symptoms and more management issues. The population of this study focused on asthmatic children living in family emergency homes shelter. Asthma rates were considered along with hospitalization and emergency department use and behavior that is important for school success.

This study concluded that young children in the homeless family shelters have a higher rate of asthma, have increased hospitalizations, have behavior problems and lower academic function at school. This study identified that nationally, there are also differences in asthma severity, management/types of service use, and mortality by racial group.

In 2003–2004, national data showed that, compared with white children, black children had 3.5 times the number of emergency department (ED) visits for asthma, 3.5 times the number of hospital stays, and 6 times as many asthma-related deaths.

Horner, S.D. (2008). Childhood asthma in rural environment, implications for clinical nurse specialist practice. *Clinical Nurse Specialist, 22 (4*), 192-200.

The object of this study was to indentify factors impacting asthma morbidity in rural school age children. The population reviewed was children ages 2-5 years old, which had current asthma. Previous studies indicate a lower prevalence of asthma in rural areas, with fewer asthma symptoms days and fewer allergic triggers. Thoughts regarding allergens, seasonal crops, dust and dander are frequently higher in rural areas.

<u>Asthma triggers that were higher in rural areas included</u>:

- Pesticide spraying of crops
- Waste/dump sites located in rural rather than urban areas
- Bacterial endotoxins from farm animals
- Air pollution (ozone, indoor carbon monoxide, methane gases)

<u>Rural children differences in asthma</u>

- Less likely to be sensitive to domestic pet dander (e.g., cats, dogs)
- Were more sensitive to farm animals (e.g., horse, cow, pig, storage mites)

Results indicated that rural children asthma severity is significantly associated with parent asthma management, absenteeism, and hospitalization, but not with ED visits.

James, C.V., and Rosenbaum, S.(2009). Paying for quality care: implications for racial and ethnic health disparities in pediatric asthma. *Pediatrics, 123*, 205.

Statistics in 2004:
300,000 children were admitted to the hospital with asthma related problems, incurring 2.4 billion dollars.
340,000 children were discharged from the emergency departments, resulting in $280 million dollars.

The study reviewed the significance of the underuse of ambulatory clinical management services that chronically ill children who present to the emergency room could utilize for regular visits. There is has been increasing incidence for payers (Medicaid, and CHIP) to be interested in incentivizing specialists and surgeons, as well as primary care physicians; are moving to include cost efficiency and information technology measures; and are increasingly including outcome measures in their Pay for Performance (P4P) programs. These programs tend to direct care in compliance with national guidelines. Incomplete or inaccurate measurement of quality health care delivery is an ongoing issue with asthmatic children.

HEDIS (Healthcare Effectiveness Data and Information Set)
Limitations include: large number of differing treatment procedures
Burden of accurate collection and comprehensive evaluation
Only limited to asthma treatment with drug therapy and consumption of resources

The problem with this measure is in failure to adhere to drug regimen and not under use of seeking medial prescription. Currently, there are no programs in pay for performance that feature an aim at reducing racial and ethnic disparities in the care of asthmatic children.

Kim, H., Kieckhefer, G.M., Greek, A.A>, Joesch, J.M., and Baydar, N.(2009). Health care utilization by children with asthma. Retrieved from www.cdc.gov/pcd/issues/2009/jan/07_0199.htm on March 31, 2012.

This article examined the differences of service utilization among children with asthma and it's association between different race, ethnicity, socioeconomic status (family income, mother's education), and health insurance coverage. Data examined were pulled from the Medical Expenditure Panel Survey (MEPS), developed by Agency for Healthcare Research and Quality (AHRQ).

The following concepts were noted:
Children, whose mothers had more education, did more checkups and fewer emergency department visits. Children who were insured used more health services for asthma, but not including emergency department visits. Minority children and children of socioeconomically disadvantaged families use more urgent care and less preventative care.

This study reviewed four aspects of health resources
1. Office visits
2. Emergency department visits
3. Prescription refills
4. Well child care general check ups

Results:

- Black children had to lowest level of office visits and the highest emergency department visits.
- A child in low income families has the lowest level of prescription refills.
- Overall, black children, children from low-income families, children whose mothers had less than a high school education, and children who had no insurance had the fewest checkups.
- Black and Puerto Rican children have more asthmatic attacks then whites
- Minority children are less likely to use anti inflammatory or controller medications to prevent asthma attacks.
- Hispanic children have a higher level of office visits
- Puerto Ricans have the highest number of prevalence

Samnaliev, M., Baxter, J.D. and Clark, R. (2009). Comparative evaluation of two asthma care quality measures among Medicaid beneficiaries. *CHEST, 135,* 1193-1197.

A study reviewed patients with persistent and intermittent asthma using only claims and pharmaceutical data from the HEDIS (Health Effectiveness and Data Information Set) in five Medicaid populations.

They reviewed both filling of prescriptions for controller asthma medications within one year and the ratio of controller medication to the total number of asthma medications prescriptions filled within one year. From those two, they calculated whether meeting each quality measure was associated with decreased odds of emergency department treatment episodes.

Results: Patients' who met the two measures was associated with lower odds of ED treatment of asthma in all patients (all ages).

Schatz, M., Clark, S., Emond, J.A., Schreiber, D., and Camargo, C.A. (2005). Sex differences among children 2-13 years of age presenting at the emergency department with acute asthma. *Pediatric Pulmonology, 37,* 523-529.

The Emergency Medicine Network (EMNET) includes 140 emergency departments that used standardized protocols to evaluate the pre ED and the post ED clinical course in patient presenting with asthma. This data base analysis reviewed all children 18 years and younger who presented to the ED with asthma.

Results:

- Asthma in the ED is %50 more common in boys than girls under age 14. This is similar to past studies examining the same phenomenon.
- Girls are more likely to report prior hospitalization than boys.
- Girls were more likely to be admitted
- During the 2 week follow up, males were more compliant with steroid use.

This author feels that data presentation is reflective of differences in prevalence, and not severity or management.

To, T., Wang, C., Dell, S., Fleming-Carroll, B., Parkin, P., Scolnik, D., and Ungar, W.(2008). Risk factors for repeat adverse asthma events in children after visiting an emergency department. *Ambulatory Pediatrics, 8*, 281-287.

The aim was to identify risk factors for long term adverse outcomes in children with asthma after visiting the emergency department.

The study demonstrated significant improvement in long term outcomes in children seeking cute care for asthma in the ED. Risk factor identification can help target vulnerable populations for proper interventions which may include efforts to maximize insurance coverage for asthma medications and strategies to improve asthma self management .

At one month follow up there was a slight upward trend of deterioration of health, or increase in reported symptoms. This was still significantly better than symptoms reported at the emergency room. The next 6 months followed were still reported to be better controlled symptoms.

Having drug insurance coverage was a significant factor against adverse asthma events at 6 month follow-up, indicating a direct relationship with affordability and accessibility of asthma medications is the largest barrier to controlling symptoms.

Withy, K., Davis, J. (2008). Follow up after emergency department visit for asthma: urban/rural patterns. *Ethnicity and Disease, 18 (2 suppl 2),* s2-247-51.

This study reviewed the patterns of follow up care to determine if those of urban areas have poorer health than do those who live in urban areas. The population reviewed were claims information on children living in Hawaii, for five years, analyzing demographic information.

<u>Results found:</u>

- Patients who had an office visit after their ED visit were 10% less likely to have a repeated ED visit.
- Rural residences were significantly less likely to have both follow up office visit, and ED visit.

This study concludes that follow up visits are key association with a decrease in emergency visits, no difference was found to associate urban or rural dwelling and use of follow up appointment in children. Meaning, the location of urban or rural did not affect the rate of follow up, but those that did not follow up, did have an association with repeated ED visit.

Wright,K. (2009). Disparities and predictors of emergency department use among California's African American, Latino and White Children age 1-11 years with asthma. *Ethnicity and Disease, 19,* 71-77.

Study reviewed a secondary analysis of parental reports of emergency department use by children with asthma. This resulted in the findings of 1.82 times or 95% of African American children and 1.23 times or 95% of Latino children were more likely to than White children to visit the ED for asthma symptoms.

Population data was taken from the California Health Interview Survey (CHIS), and were true across multiple disparities.

Other predictions of ED use are:
Health insurance type
Single parent home
Asthma severity
Disability

CAPQuaM

Care of the Pediatric Asthmatic Patient in the Emergency Department

Phase II Literature Review

December 14, 2012

Submitted by:
The Joint Commission
One Renaissance Boulevard
Oakbrook Terrace, IL 60181

Executive Summary

Asthma is one of the most common chronic diseases in children and a frequent cause of emergency department visits and hospital admissions. Although there have been important gains in reducing asthma morbidity and mortality, the burden of avoidable hospital visits continues to confront the health care system. The challenge remains to help asthmatic children receive quality care and improve their quality of life, particularly for those at high risk for poor outcomes.

Three research questions have been posed that will inform the development of a measure construct designed to address evidence-based, effective interventions related to the provision of asthma care to children.

The first research question considers patterns of care/asthma management with respect to there being a correlation between the frequency of asthma visits and the likelihood of asthma Emergency Department (ED) events.

Children, who have uncontrolled asthma, have an increased need for asthma care from a health care provider. The severity of symptoms and the lack of available urgent care services are reasons why parents take their children to the emergency room. It has been demonstrated that children who used the ED underutilized primary care services.

A number of interventions have been shown to impact and potentially decrease emergency visits. ED visits are reduced when children are cared for in a facility or organization that provides enhanced hours of service and these centers communicate with the child's primary care provider. It has also been demonstrated that coordinated asthma care lead by a clinician associated with a multidisciplinary model; such as a medical home, is associated with fewer ED visits.

The second research question explores who is primarily providing asthma care and the characteristics of the care provided.

Primary care providers, nurse practitioners, registered nurses, community health workers, and home visitors, are all found to be effective providers for the management of pediatric asthmatic patients. One systematic review concluded that the use of community health workers to deliver interventions resulted in the following improved outcomes: decrease in asthma symptoms, decrease in daytime activity limitations, and reduced emergency and urgent care use. Another study demonstrated positive results with the use of lay educators.

Multidisciplinary asthma disease management showed improvement in several cases, and emergency service and hospitalizations were reduced when multidisciplinary care was utilized.

For patients with limited access to care, it was found that outreach programs, school-based programs, and asthma centers were effective in the management of asthma by improving outcomes of asthmatic children. The interventions implemented by some of these programs and centers demonstrated: a decrease in hospitalizations, reduction in emergency room visits, decreased clinic visits for treatment of acute exacerbations, and fewer days absent from school. Additionally it was found that children who used an asthma center instead of the emergency department were more likely to use maintenance anti-inflammatory medications.

The final research question reviews the utilization of asthma care and the impact of ancillary services/multidisciplinary teams.

The literature identified a number of issues that challenge the delivery of appropriate asthma care:

- Primary care physician lack of knowledge of asthma guidelines
- Lack of parents understanding of the severity of the disease
- Poor adherence to medication management
- Barriers to resource procurement

A number of programs have been implemented worldwide with a focus on physician education and implementation of multidisciplinary teams for asthma care management. A common theme with respect to care provided by primary care physicians and care delivered by multidisciplinary teams was the importance of adherence to the National Asthma Education and Prevention Program (NAEPP) guidelines.

There are a variety of multidisciplinary care team models. Some are lead by nurse practitioners, others by masters prepared social workers. Team members also include pediatric allergists and Certified Pediatric Nurse Practitioners (CPNPs). There are programs with demonstrated success using lay health workers who serve as a liaison between families and the health care system.

Common elements found in multidisciplinary team models that contribute to the success of the programs:

- Intensive asthma education
- Development of an individualized asthma action plan
- Home visitation with environmental assessment of triggers
- Medication management
- Routine follow-up

The positive impact of the multidisciplinary team care model can be attributed to components of care that may not be available with care rendered solely by a primary care physician. Availability of the team is a major component, in that some services are available 24 hours a day, 7 days a week whereby a single phone call may be all that's needed to avoid a trip the emergency room. Home visitation is a key component in that it allows for patient assessment that cannot be conducted in the physician office. The benefit of assessing actual asthma triggers in the home, in addition to observance of medication administration, allows for real time education of the patient and family.

Ancillary services and multidisciplinary care providers are viewed as having a positive impact on asthma care management of children. The team process fosters adherence to clinical practice guidelines, intensive asthma education, and medication compliance, all of which demonstrate the potential for decreasing emergency department visits and in-patient hospital admissions.

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I. Methodology

Phase I Methodology:

The work began with a review of the Asthma Construct Table. The search process was guided by six concepts within the construct:
1. Need to Specify Population for Measure
2. Adequacy of Management of Asthma
3. Adequacy of PCP Practice Site to Handle Acute Exacerbations
4. The Connectedness of Care in the Primary Care and ED Setting
5. Equity is a Value in Asthma Care

The search was conducted from March 2012 – April 2012. 12, 800 citations retrieved, 157 sources used.

PubMed Search
Limitations to this search included only those articles in English pertaining to ages 0-18 years old.

The following strategies were used:
Search 1
Search terms:
"Physician-Patient Relations" [Mesh]) AND "Asthma" [Majr] (relationship [ti] or role [ti])
"Physician, Primary Care" [Mesh] AND asthma [Majr] AND (relationship or role [ti])
"Disease Management" [majr] AND asthma [majr]
"Asthma/diet therapy" [Majr] OR "Asthma/drug therapy" [Majr] OR "Athsma/therapy" [majr]
"Asthma/diagnosis" [Majr]
("Emergency Service, Hospital" [Majr] OR "ED visit") AND Asthma [majr]
"Self care" [majr] AND asthma [majr]
"Patient education as topic" [majr] AND asthma [majr]
"Reminder Systems" [majr] AND asthma [majr]
("Social Media" [mesh] OR internet [mesh] or twitter) AND asthma [majr]
("Healthcare disparities"[mesh] or "minority health" [mesh]) AND asthma [majr]

Search 2
A second limited search as done on the following free text terms:
"African American" AND asthma
"Black" AND asthma
"Latino" AND asthma
"Asian" AND asthma
"Race" AND Asthma
No sources were retrieved from this additional search. The articles used in this review were selected reflect the nature of the above search terms, as the same key words were present in the sources. It is assumed an exhaustive search would have resulted in the same article selection.

Web Search
An internet search was performed. The following terms were searched:
"Capacity of PCPs to manage children asthma"
"Asthma office visits"
"Access to asthma specialist"
"Wait time to see asthma physician"

Phase II Methodology:

The work began with a review of the Asthma Gap Analysis. The search process was guided by 3 revised research questions:

1. Patterns of care/asthma management. Does frequency of asthma visits impact likelihood of asthma Emergency Department event?
2. Who is primarily providing the asthma care (e.g. Basic characteristics of providers that care for a child with asthma)? Do the characteristics of the person providing asthma care influence outcomes (this may include medical records, parent self-report, retrospective cohort studies)?
3. Utilization of asthma care and the impact of ancillary services/multidisciplinary team (e.g. nurse practitioners, social workers).
4. Grey Literature

******The baseline question: At the population level, how do you identify (specify that patient has) asthma (e.g. ICD-9 codes)?

- This question was used to define the population for the search methodology for each of the three research questions above.
- The strategy used was Asthma[majr] which yielded 24,755 articles
- Key Articles used for this search were supplied by the Mt Sinai Asthma Research Team

From the Phase I Gap Analysis a number of articles were deemed appropriate.

- Question 1, **13** articles were deemed appropriate
- Question 2, **0** articles were deemed appropriate
- Question 3, **6** were deemed appropriate

These articles were then reviewed full text and disseminated into the Phase II literature review.

The Phase II Literature Review search was conducted from September 2012. **921** citations were retrieved. **91** citations were included in the Phase II Literature Review. However, with removal of duplicate citations, **79** sources yielded for the Phase II Literature Review.

<u>Research Question 1</u>

PubMed Search
The following strategies were used:
Search Terms:

Asthma[majr]
AND ("delivery of health care"[mesh] OR "primary health care"[mesh] OR "ambulatory care"[mesh] OR "ambulatory care facilities"[mesh] OR "episode of care"[mesh] OR "office visits"[mesh] OR "medical home" OR variation OR patterns OR "physician's practice patterns"[mesh])) AND "emergency service, hospital"[mesh]

Filters: Publication date from 1970/01/01; Humans; English; Child: birth-18years

- The search yielded **311** articles. Abstracts and titles were evaluated for content.

CINAHL Search
The following strategies were used:

Search Terms:

MJ asthma AND (MW “health care delivery” OR MQ “primary health care” OR MW “ambulatory care” OR MW “ambulatory care facilitites” OR MW “office visits” OR MW “practice patterns” OR “medical home” OR variation OR pattern) AND (MW “emergency service”)

Limiters: Published Date from: 19700101-20120931; English Language; Exclude MEDLINE records; Human; Subject Age: adolescent: 13-18 years; Subject Age: all child

- The search yielded **5** articles. Abstracts and titles were evaluated for content.

Cochrane Database of Systematic Reviews (EBSCO) Search
The following search strategies were used:

Asthma AND (guidelines OR management) AND (child or children)

- The search yielded **54** articles. Abstracts and titles were evaluated for content. This produced **1** full-text source that was distributed to Research Question 1’s endnote library for further review.

National Guidelines Clearinghouse Search
The following search strategies were used:

asthma (disease or condition)
ages (infant newborn, child, adolescent)

- The search yielded **44** guidelines. Titles were evaluated for content. This produced **13** guidelines of which **8** were distributed to Research Question 1’s endnote library for further review.

National Quality Measure Clearinghouse Search
The following search strategies were used:

asthma AND (child or children)

- The search yielded **56** measures. Titles were evaluated for content. This produced **6** measures of which **5** were distributed to Research Question 1’s endnote library for further review.

National Quality Forum Search
The following search strategies were used:

asthma

Filters: Children’s Health

- The search yielded **13** measures. Titles were evaluated for content. This produced **7** measures of which **2** were distributed to Research Question 1’s endnote library for further review.

❖ Duplicate sources yielded from National Guideline Clearinghouse, National Quality Measure Clearinghouse, and National Quality Forum were removed prior to full-text review of sources.

Grey Literature Search
The following websites were reviewed in effort to ensure that grey literature was examined:

1. NHLBI – National Heart, Lung, & Blood Institute, 2007: http://www.acaai.org/allergist/asthma/asthma-treatment/asthma-diagnosis/pages/asthma-guidelines.aspx
2. GINA – Global Initiative for Asthma: http://www.ginasthma.org/Guidelines/guidelines-resources.html
3. American Academy of Family Physicians: Tools and Strategies for Improving Asthma Management: http://www.aafp.org/fpm/2010/0100/p16.html

Phase I Gap Analysis

- **13** articles were deemed appropriate for the revised Research Question 1 from the Phase I Gap Analysis.
- **7** of the 13 articles deemed appropriate were included for review in the Phase II Literature Review.
- **6** remaining articles of the 13 articles deemed appropriate, were duplicated in the Phase II Search Methodology and therefore were not added to the consort diagram number totals.

The total number of full-text articles reviewed for the revised Research Question 1 was **108**.

Of the 108 articles under full text review, **33** articles were annotated for analysis of this review.

<u>Research Question 2</u>

PubMed Search
The following strategies were used:
Search Terms:

Asthma[majr]
AND (“health personnel”[mesh] OR “primary health care”[mesh] OR “patient care team”[mesh] “interdisciplinary communication”[mesh] OR “emergency service, hospital”[mesh] OR “continuity of patient care”[mesh] OR “family practice”[mesh] OR “family medicine” OR specialization[mesh] OR specialists OR “specialty care” OR “pulmonary medicine”[mesh] OR pulmonologists OR “managed care programs”[mesh]) AND “outcome assessment (health care)”[mesh]

Filters: Publication date from 1970/01/01; Humans; English; Child: birth-18years

- The search yielded **287** articles. Abstracts and titles were evaluated for content.

CINAHL Search
The following strategies were used:
Search Terms:

MJ asthma AND (MW “health personnel” OR MW “primary health care” OR MW “multidisciplinary care team” OR MW “emergency service” OR MW “continuity of patient care” OR MW “family practice” OR “family medicine” OR MW specialization OR “specialty care” OR specialists OR “pulmonary medicine” OR pulmonologists OR MW “managed care programs”) AND (MW “outcomes (health care)”)

Limiters: Published Date from: 19700101-20120931; English Language; Exclude MEDLINE records; Human; Language: English; Age Groups: All Child

- The search yielded **7** articles. Abstracts and titles were evaluated for content.

Cochrane Database of Systematic Reviews (EBSCO) Search
The following search strategies were used:

Asthma AND (guidelines OR management) AND (child or children)

- The search yielded **54** articles. Abstracts and titles were evaluated for content. This produced **1** full-text source that was distributed to Research Question 2's endnote library for further review.

National Guidelines Clearinghouse Search
The following search strategies were used:

asthma (disease or condition)
ages (infant newborn, child, adolescent)

- The search yielded **44** guidelines. Titles were evaluated for content. This produced **13** guidelines of which **13** were distributed to Research Question 2's endnote library for further review.

National Quality Measure Clearinghouse Search
The following search strategies were used:

asthma AND (child or children)

- The search yielded **56** measures. Titles were evaluated for content. This produced **6** measures of which **6** were distributed to Research Question 2's endnote library for further review.

National Quality Forum Search
The following search strategies were used:

asthma

Filters: Children's Health

- The search yielded **13** measures. Titles were evaluated for content. This produced **7** measures of which **6** were distributed to Research Question 2's endnote library for further review.

❖ Duplicate sources yielded from National Guideline Clearinghouse, National Quality Measure Clearinghouse, and National Quality Forum were removed prior to full-text review of sources.

Grey Literature Search
The following websites were reviewed in effort to ensure that grey literature was examined:

1. NHLBI – National Heart, Lung, & Blood Institute, 2007: http://www.acaai.org/allergist/asthma/asthma-treatment/asthma-diagnosis/pages/asthma-guidelines.aspx

2. GINA – Global Initiative for Asthma: http://www.ginasthma.org/Guidelines/guidelines-resources.html
3. American Academy of Family Physicians: Tools and Strategies for Improving Asthma Management: http://www.aafp.org/fpm/2010/0100/p16.html

Phase I Gap Analysis

- **0** articles were deemed appropriate for the revised Research Question 2 from the Phase I Gap Analysis.

The total number of full-text articles reviewed for the revised Research Question 2 was **62**.

Of the 62 articles under full text review, **33** articles were annotated for analysis of this review.

Research Question 3

PubMed Search
The following strategies were used:
Search Terms:

Asthma[majr]
AND("community health services"[mesh] OR "social work"[mesh] OR nurses[mesh] OR "health educators"[mesh] OR "patient care team"[mesh] OR "interdisciplinary communication"[mesh] OR "complementary therapies"[mesh] OR "allied health personnel"[mesh] OR caregivers[mesh]) AND ("health services/utilization"[mesh] AND ("outcome assessment (health care)"[mesh] OR "quality of health care"[mesh]))

Filters: Publication date from 1970/01/01; Humans; English; Child: birth-18years

- The search yielded **130** articles. Abstracts and titles were evaluated for content.

CINAHL Search
The following strategies were used:
Search Terms:

MJ asthma AND (MW "community health services" OR MW "social work" OR MW nurses OR MW "health educators" OR MW "multidisciplinary care team" OR MW "alternative therapies" OR MW "allied health personnel" OR MW caregivers) AND (MW "health services/utilization" OR MW "quality of health care")

Limiters: Published Date from: 19700101-20120931; English Language; Exclude MEDLINE records; Human; Language: English; Age Groups: All Child

- The search yielded **2** articles. Abstracts and titles were evaluated for content.

Cochrane Database of Systematic Reviews (EBSCO) Search
The following search strategies were used:

Asthma AND (guidelines OR management) AND (child or children)

- The search yielded **54** articles. Abstracts and titles were evaluated for content. This produced **1** full-text source that was distributed to Research Question 3's endnote library for further review.

National Guidelines Clearinghouse Search
The following search strategies were used:

asthma (disease or condition)
ages (infant newborn, child, adolescent)

- The search yielded **44** guidelines. Titles were evaluated for content. This produced **13** guidelines of which **1** were distributed to Research Question 3's endnote library for further review.

National Quality Measure Clearinghouse Search
The following search strategies were used:

asthma AND (child or children)

- The search yielded **56** measures. Titles were evaluated for content. This produced **6** measures of which **2** were distributed to Research Question 3's endnote library for further review.

National Quality Forum Search
The following search strategies were used:

asthma

Filters: Children's Health

- The search yielded **13** measures. Titles were evaluated for content. This produced **7** measures of which **0** were distributed to Research Question 3's endnote library for further review.

❖ Duplicate sources yielded from National Guideline Clearinghouse, National Quality Measure Clearinghouse, and National Quality Forum were removed prior to full-text review of sources.

Grey Literature Search
The following websites were reviewed in effort to ensure that grey literature was examined:

1. NHLBI – National Heart, Lung, & Blood Institute, 2007: http://www.acaai.org/allergist/asthma/asthma-treatment/asthma-diagnosis/pages/asthma-guidelines.aspx
2. American Academy of Family Physicians: Tools and Strategies for Improving Asthma Management: http://www.aafp.org/fpm/2010/0100/p16.html

Phase I Gap Analysis

- **6** articles were deemed appropriate for the revised Research Question 3 from the Phase I Gap Analysis.
- **4** of the 6 articles deemed appropriate were included for review in the Phase II Literature Review.
- **2** remaining articles of the 6 articles deemed appropriate, were duplicated in the Phase II Search Methodology and therefore were not added to the consort diagram number totals.

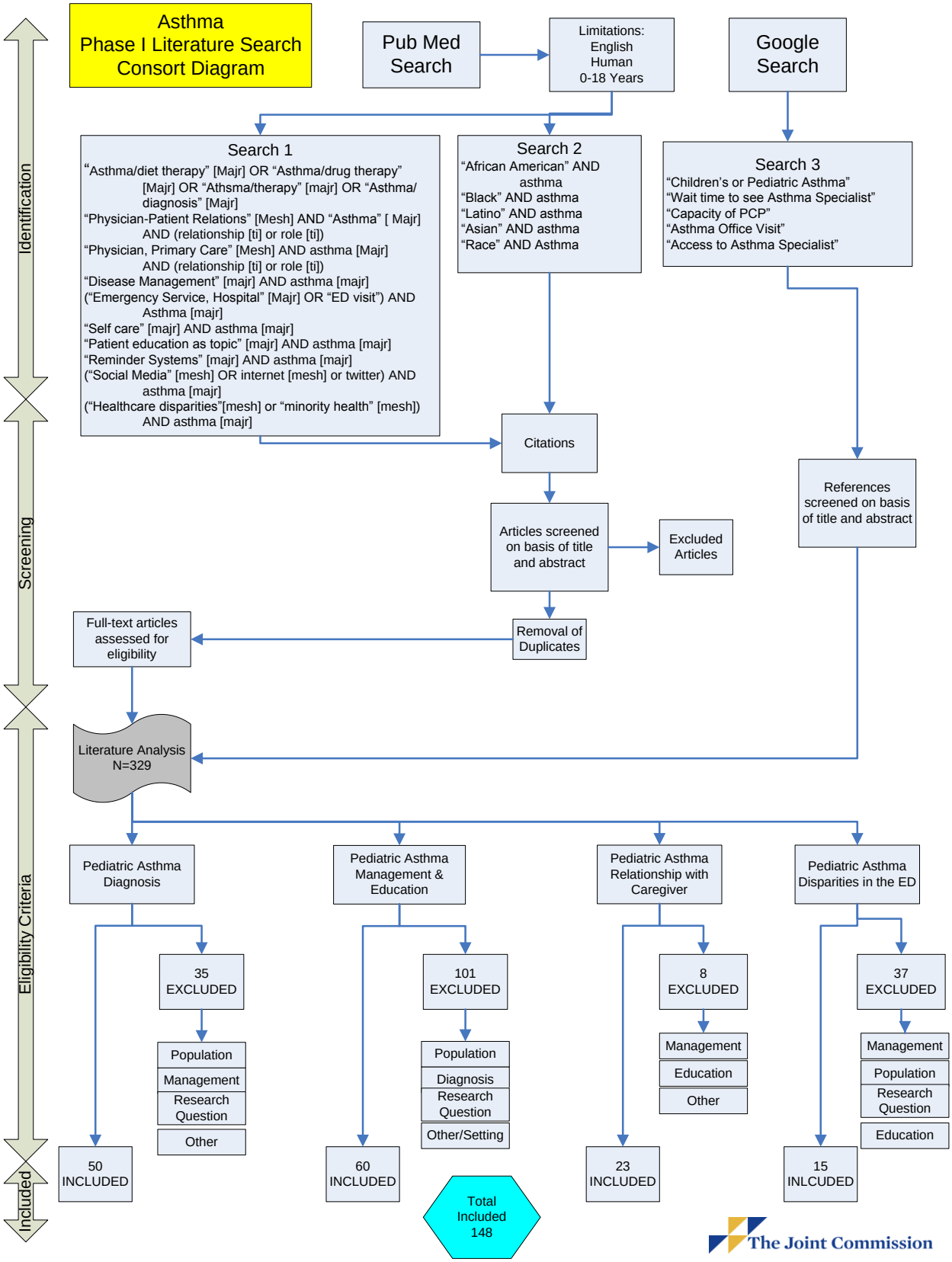
The total number of full-text articles reviewed for the revised Research Question 3 was **53**.

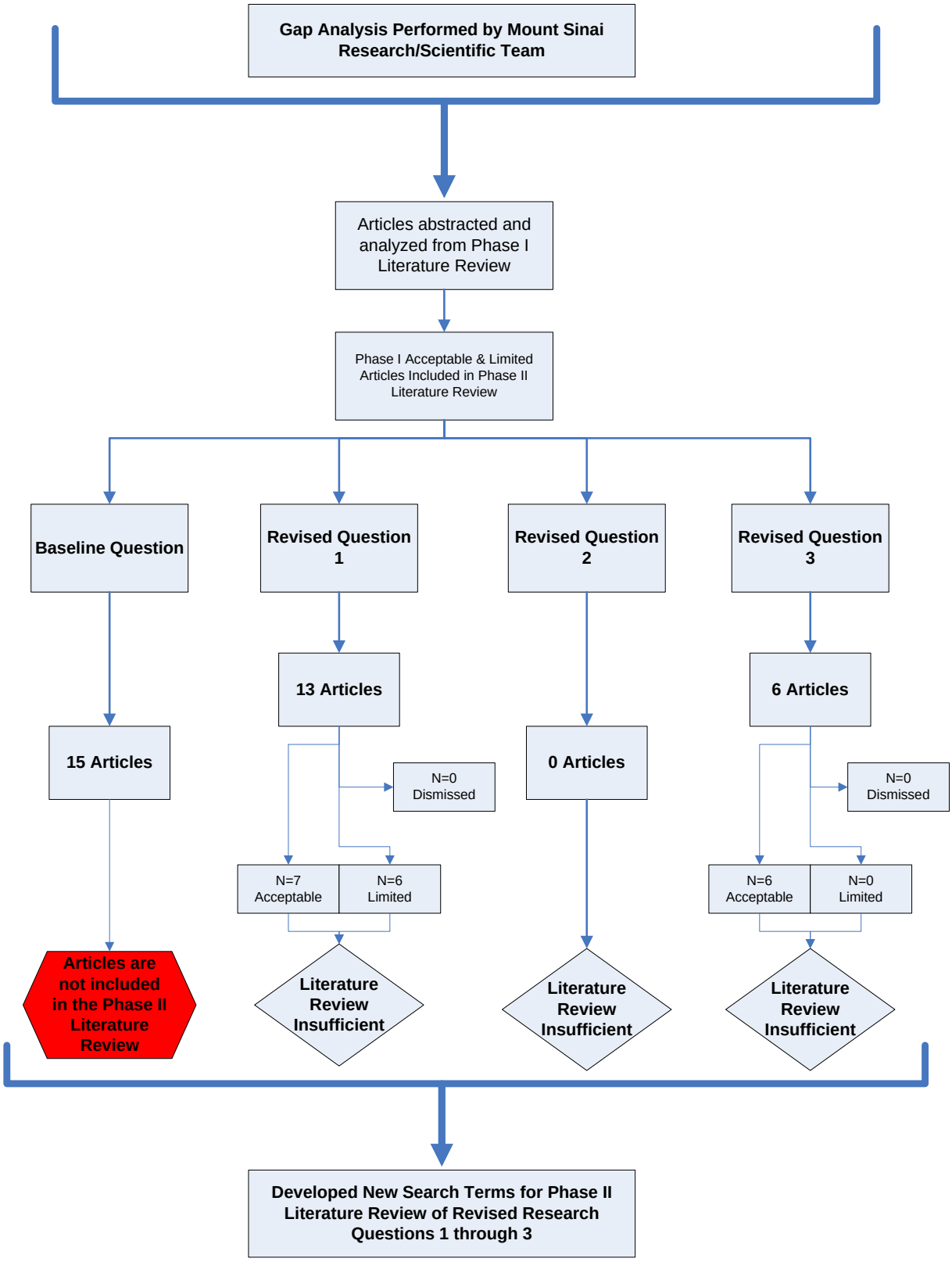
Of the 53 articles under full text review, **23** articles were annotated for analysis of this review.

Grey Literature Search

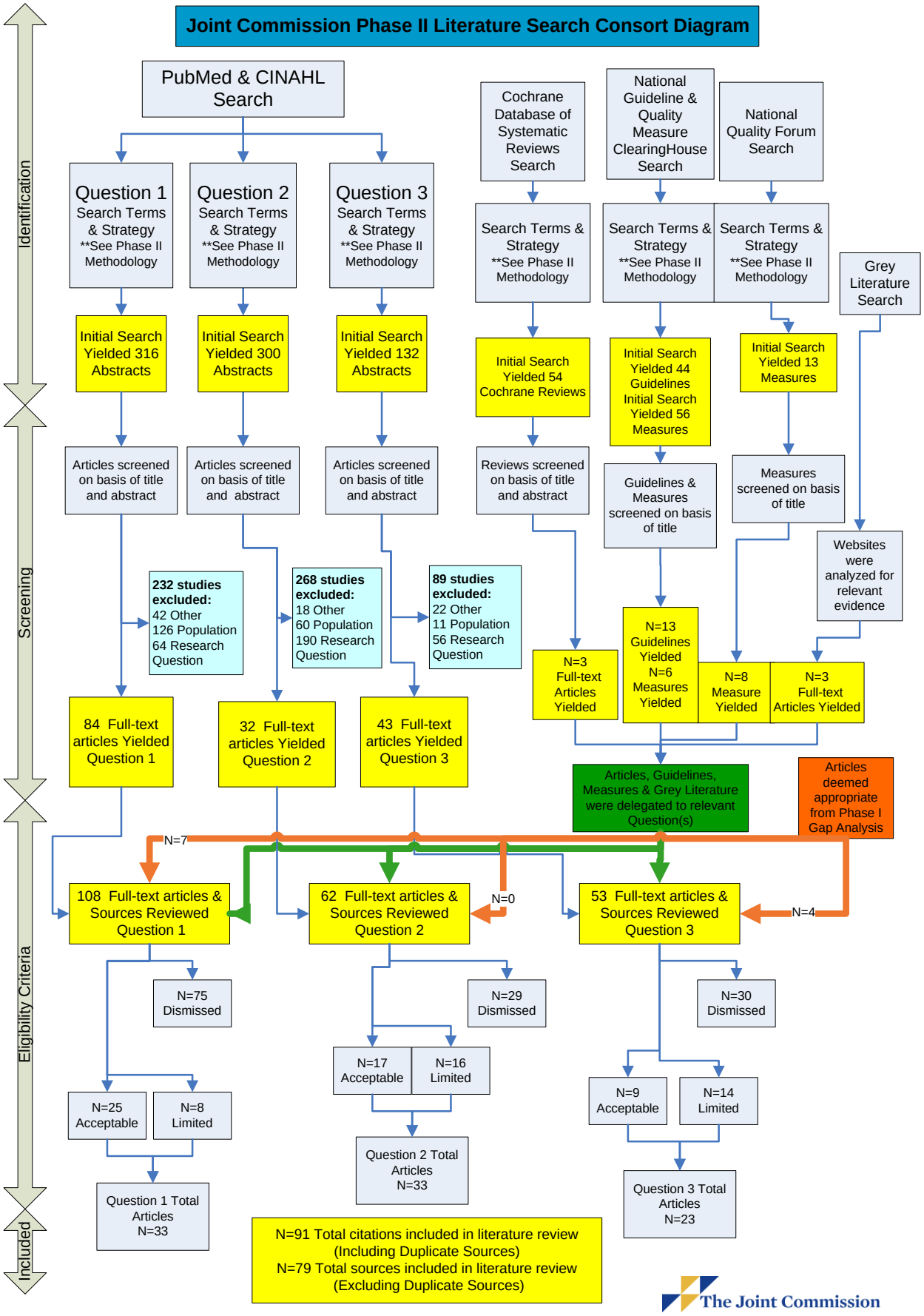
The following websites were reviewed in effort to ensure that grey literature was examined:

1. NHLBI – National Heart, Lung, & Blood Institute, 2007: http://www.acaai.org/allergist/asthma/asthma-treatment/asthma-diagnosis/pages/asthma-guidelines.aspx
2. American Academy of Family Physicians: Tools and Strategies for Improving Asthma Management: http://www.aafp.org/fpm/2010/0100/p16.html


Asthma
Phase I Literature Search
Consort Diagram
Pub Med Search
Limitations:
English
Human
0-18 Years
Google Search
Search 1
"Asthma/diet therapy" [Majr] OR "Asthma/drug therapy" [Majr] OR "Athsma/therapy" [majr] OR "Asthma/ diagnosis" [Majr]
"Physician-Patient Relations" [Mesh] AND "Asthma" [Majr] AND (relationship [ti] or role [ti])
"Physician, Primary Care" [Mesh] AND asthma [Majr] AND (relationship [ti] or role [ti])
"Disease Management" [majr] AND asthma [majr]
("Emergency Service, Hospital" [Majr] OR "ED visit") AND Asthma [majr]
"Self care" [majr] AND asthma [majr]
"Patient education as topic" [majr] AND asthma [majr]
"Reminder Systems" [majr] AND asthma [majr]
("Social Media" [mesh] OR internet [mesh] or twitter) AND asthma [majr]
("Healthcare disparities"[mesh] or "minority health" [mesh]) AND asthma [majr]
Search 2
"African American" AND asthma
"Black" AND asthma
"Latino" AND asthma
"Asian" AND asthma
"Race" AND Asthma
Search 3
"Children's or Pediatric Asthma"
"Wait time to see Asthma Specialist"
"Capacity of PCP"
"Asthma Office Visit"
"Access to Asthma Specialist"
Identification
Citations
Screening
Articles screened on basis of title and abstract
Excluded Articles
References screened on basis of title and abstract
Removal of Duplicates
Full-text articles assessed for eligibility
Literature Analysis N=329
Eligibility Criteria
Pediatric Asthma Diagnosis
Pediatric Asthma Management & Education
Pediatric Asthma Relationship with Caregiver
Pediatric Asthma Disparities in the ED
35 EXCLUDED
Population
Management
Research Question
Other
101 EXCLUDED
Population
Diagnosis
Research Question
Other/Setting
8 EXCLUDED
Management
Education
Other
37 EXCLUDED
Management
Population
Research Question
Education
Included
50 INCLUDED
60 INCLUDED
23 INCLUDED
15 INLCUDED
Total Included 148
The Joint Commission



The Joint Commission


Joint Commission Phase II Literature Search Consort Diagram
Identification
Screening
Eligibility Criteria
Included
PubMed & CINAHL Search
Question 1 Search Terms & Strategy **See Phase II Methodology
Question 2 Search Terms & Strategy **See Phase II Methodology
Question 3 Search Terms & Strategy **See Phase II Methodology
Cochrane Database of Systematic Reviews Search
National Guideline & Quality Measure ClearingHouse Search
National Quality Forum Search
Search Terms & Strategy **See Phase II Methodology
Search Terms & Strategy **See Phase II Methodology
Search Terms & Strategy **See Phase II Methodology
Grey Literature Search
Initial Search Yielded 316 Abstracts
Initial Search Yielded 300 Abstracts
Initial Search Yielded 132 Abstracts
Initial Search Yielded 54 Cochrane Reviews
Initial Search Yielded 44 Guidelines Initial Search Yielded 56 Measures
Initial Search Yielded 13 Measures
Articles screened on basis of title and abstract
Articles screened on basis of title and abstract
Articles screened on basis of title and abstract
Reviews screened on basis of title and abstract
Guidelines & Measures screened on basis of title
Measures screened on basis of title
Websites were analyzed for relevant evidence
232 studies excluded: 42 Other 126 Population 64 Research Question
268 studies excluded: 18 Other 60 Population 190 Research Question
89 studies excluded: 22 Other 11 Population 56 Research Question
N=3 Full-text Articles Yielded
N=13 Guidelines Yielded N=6 Measures Yielded
N=8 Measure Yielded
N=3 Full-text Articles Yielded
84 Full-text articles Yielded Question 1
32 Full-text articles Yielded Question 2
43 Full-text articles Yielded Question 3
Articles, Guidelines, Measures & Grey Literature were delegated to relevant Question(s)
Articles deemed appropriate from Phase I Gap Analysis
N=7
N=0
N=4
108 Full-text articles & Sources Reviewed Question 1
62 Full-text articles & Sources Reviewed Question 2
53 Full-text articles & Sources Reviewed Question 3
N=75 Dismissed
N=29 Dismissed
N=30 Dismissed
N=17 Acceptable
N=16 Limited
N=9 Acceptable
N=14 Limited
N=25 Acceptable
N=8 Limited
Question 2 Total Articles N=33
Question 3 Total Articles N=23
Question 1 Total Articles N=33
N=91 Total citations included in literature review (Including Duplicate Sources)
N=79 Total sources included in literature review (Excluding Duplicate Sources)
The Joint Commission

II. Research Question 1
Does the frequent of asthma visits impact the likelihood of asthma ED event?

Summary

Children, who have uncontrolled asthma, have a fivefold increased risk for asthma related doctor visits, as well as Emergency Department (ED) visits (Guilbert, et al., 2011). Cabana et al., 2003, researched emergency department visits, with an emphasis on repeat visits and found that younger children and those on Medicaid, sought out healthcare for their asthma from the ED. The study also determined that two thirds of the patients who had an ED asthma visit did not comply with the recommended 30 day follow-up visit. Ambulatory care statistics that predispose emergency visits show that children are not frequently accessing and utilizing non urgent care to reduce the likelihood of the asthma emergency event.

The literature review found a noted difference in care for those children who had access to an asthma center. Battleman, et al., (2006) found significant differences in disparities in the quality of care, access and resource utilization, and functional impact between those treated at the asthma center and those treated in an ED. Asthma center patients were more likely to report the ability to call for assistance during off hours and outpatient management when compared to ED only patients. Functional impact was measured by lost days of school, with asthma center patients having less. Authors note the opportunity for ED physicians to improve patient care to the asthmatic patient. Referral to asthma care center post urgent visit is advisable.

Interestingly, Lara et al., (2003), found that children who used the ED did not utilize any primary care. This study found that symptom severity was the major cause reported by parents for presentation to the ED. Financial circumstances, including lack of insurance were not contributory reasons for seeking emergency care.

There were many factors that were examined to predict asthma readmission to the emergency department. The following were identified in reducing asthma emergency visits, or recurrence of need for urgent care:

- Frequency of allergy visits
- Coaching education with Clinical Nurse Specialists
- Discharge with Budesonide
- Appropriate medication use
- Primary Care Medical Home
- Appointment keeping with home physician
- Emergency use of rescue medications
- Asthma attack prevention with allergy reduction

Greinder et al., (1995), determined that emergency use was reduced with the use of an Asthma Outreach Nurse addressing patient education. Specifically, one to one orientation addressing instructions on management, triggers, use of inhalers, and peak flow meters was found effective. However, in regards to ED readmission, Courtney et al., (2005) found that education was not a factor that reduced ED readmission rates, rather, the use of high doses of inhaled corticosteroids during the first ED visit reduced ED readmissions.

Receiving coordinated care lead by a clinician associated with a multidisciplinary care team, such as in a primary care medical home, is associated with fewer ED visits (Diedhiou et al., 2010). Children rendered care through a medical home had 7% fewer ED visits.

This literature review focused on the care of asthma patients outside of the emergency department in relation to their urgent care visits. When segmented ambulatory care was compared to comprehensive asthma treatment centers, it was found that asthma centers can lead to improved care and reduction of emergency services for asthmatic children. Key findings associated with a decrease in the need for subsequent urgent/emergency department visits included:

- Interventions such as providing enhanced hours of services have led to a clear reduction in emergency room visits.
- Communication directly with the primary care practitioner to report the severity of the asthma attacks and patient status.

This literature review found a lack of awareness among emergency physicians respecting the guidelines for treatment of asthma. This lack of guideline knowledge can contribute to treatment failures and leads to patient confusion regarding recommended treatments. Strategies related to implementation of international guidelines for the treatment of asthma have failed. Steps must be undertaken to facilitate compliance with evidence-based guidelines in order to reduce worldwide morbidity and mortality associated with asthma (Cavazos, 2006).

Bibliography

Akinbami, L. J., Moorman, J. E., Garbe, P. L., & Sondik, E. J. (2009). Status of childhood asthma in the United States, 1980-2007. *Pediatrics,* 123 Suppl 3, S131-145. doi: 10.1542/peds.2008-2233C

Impact Factor: 4.47
Quality of Evidence: Acceptable

n=Not Specified
Informational Article
This article reviews the status of childhood asthma in the U.S. from 1980-2007. The data suggests that a plateau has occurred in the population of children who have asthma. In addition, the emergency department visit and episodes of hospitalizations have decreased. Prevalence of death is higher now, (after 1999) and more deaths occur in younger children 0-4 years, yet emergency services use is down. This article reviewed only the status of emergency events, and found that emergency visits are more populated with minority children, while, ambulatory care was lower for Non-Hispanic African American children.

Alexander, J. S., Younger, R. E., Cohen, R. M., & Crawford, L. V. (1988). Effectiveness of a nurse-managed program for children with chronic asthma. *J Pediatr Nurs, 3*(5), 312-317.

Impact Factor: 4.47
Quality of Evidence: Acceptable

n=22
Randomized Controlled Trial
The study was conducted September 1983 through April 1985.
In this study Advance Practice Nurses (APN) visited and individually counseled each patient and family after discharge from the ED in one group, and traditional follow-up care was done in the other group. The visits focused on early recognition of asthma exacerbations and self care. Frequency of allergy physician contacts were reduced in the APN group, however, the total

number of outpatient visits was similar for both groups. The APN group had a reduction in the frequency of emergency room visits, versus the control group.

ARHQ. (2010). Asthma admission rate (area-level): rate per 100,000 population.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
National Quality Measures Clearinghouse ID 5587=Asthma admission rate per 100,000 in Metro Area, or county area.
The measure is used to identify the hospitalization of asthmatic pediatric (2-17 years old) patients, where asthma is identified by use of international classification of disease (ICD-9) principal diagnosis code of asthma. The measure is used by evaluating the maintenance therapy, including drug treatments, which may reduce the incidence of acute exacerbation that might require future hospitalization.

Battleman, D. S., Callahan, M. A., Silber, S., Munoz, C. I., Santiago, L., Abularrage, J., & Jabbar, H. (2001). Dedicated asthma center improves the quality of care and resource utilization for pediatric asthma: a multicenter study. *Acad Emerg Med, 8*(7), 709-715.

Impact Factor: 1.44
Quality of Evidence: Acceptable

n=330
Retrospective case control
Objective of the study was to determine the effectiveness of pediatric asthma care after patients were treated at a dedicated asthma care center. This study found significant differences in disparities in the quality of care, access and resource utilization, and functional impact between those treated at the asthma center and those treated in an ED. Asthma center patients were more likely to report the ability to call for assistance during off hours and outpatient management when compared to ED only patients. Functional impact was measured by lost days of school, with asthma center patients having less. Authors note the opportunity for ED physicians to improve patient care for the asthmatic patient. The study concludes that referral to an asthma care center post urgent care is advisable.

Butterfoss, F. D., Kelly, C., & Taylor-Fishwick, J. (2005). Health planning that magnifies the community's voice: allies against asthma. *Health Educ Behav, 32*(1), 113-128. doi: 10.1177/1090198104269568

Impact Factor: 1.54
Quality of Evidence: Acceptable

n=Not Specified
Informational Article
Consortium for Infant and Child Health (CINCH) reviewed the prevalence of asthma in Virginia. Data was collected for eight months and included the rates of ED visits by zip codes. Healthcare utilization was assessed by survey of parents of children with asthma. A need assessment was completed which then determined a community action plan. It was identified that education for

patients, parents, and providers was necessary, as well as access to coordinated, consistent and comprehensive care.

Cabana, M. D., Bruckman, D., Bratton, S. L., Kemper, A. R., & Clark, N. M. (2003). Association between outpatient follow-up and pediatric emergency department asthma visits. *J Asthma, 40*(7), 741-749.

Impact Factor: 4.15
Quality of Evidence: Acceptable

n=561
Retrospective Cohort Design
The objective of the study was to measure the frequency of follow-up outpatient asthma visits and the correlation with repeated ED visits. Asthma patients between the ages of 5-19 were included in the study and identified using ICD-9-CM codes. The intent of the study was to capture repeat ED visits. The first index ED asthma visit was identified and repeat asthma visits to the ED were those that occurred within 365 days. Analysis of study data found that more asthma visits occurred in children who were younger and those on Medicaid. Seventeen percent (103) of the children had a repeated asthma visit within one year. Focus was placed on the 94 repeat ED visits that occurred during the study allowing for sufficient time for outpatient follow-up. The study determined that 66% of the patients who had repeat ED visits did not comply with the recommended 30 day outpatient asthma follow-up visit.

Cabana, M. D. (2005). Improving care for asthma. *J Pediatr, 147*(3), 411-412; author reply 412-413. doi: 10.1016/j.jpeds.2005.03.017

Impact Factor: 1.53
Quality of Evidence: Acceptable

n=Not Specified
Letter to the Editor
Letter to the editor recognizing that specialty based centers, and successful asthma management includes multiple components;

- Correct prescriptions
- Proper techniques for using rescue inhalers
- Controller medications
- Appropriate environmental management
- Careful management of symptoms

The importance of post ED follow-up should not be disregarded. Direct communication with a Primary Care Physician for post ED interventions may be necessary to improving the coordination of care.

Callahan, C. W., Chan, D.S., Moreno, C., and Mulreany, L. (2006). Increased Diagnosis of Asthma in Hospitalized Infants: the next target population of care management. Journal of Asthma, 43, 45-47.

Impact Factor: 1.53
Quality of Evidence: Acceptable

n=179
Retrospective Review
Analysis of Department of Defense (DOD) data on hospital admissions for children younger than age 2. Data was gathered from DOD hospitals to analyze admission ages and demographics of asthmatic children. The study suggested positive outcomes are associated with early diagnosis.

A rise in the diagnosis of asthma in infants and young children over the past 5 years is found in this study. Overall rates of hospitalized children have remained constant, yet a dramatic increase was noted in the number of children or infants admitted less than 2 years of age. It is unlikely that asthma has become more prevalent in those less than 2 years of age; rather the diagnosis of asthma is being made more commonly. Perhaps, this is due to clinicians becoming more comfortable in making the diagnosis early in children, which provides for earlier education and intervention. The study also found that asthma admissions for school age children have decreased, showing a positive outcome in asthma management plans for this age group.

Camargo, C. A., Jr., Ramachandran, S., Ryskina, K. L., Lewis, B. E., & Legorreta, A. P. (2007). Association between common asthma therapies and recurrent asthma exacerbations in children enrolled in a state Medicaid plan. *Am J Health Syst Pharm, 64*(10), 1054-1061. doi: 10.2146/ajhp060256

Impact Factor: 1.93
Quality of Evidence: Acceptable

n=10,976
Retrospective Study
January 1999- June 2001: Purpose of this study was to evaluate the relationship between asthma medication adherence (Budesonide Inhalation suspension) and repeated asthma hospitalization or emergency room visits. Florida Medicaid claims were analyzed with findings confirming that patients who were discharged with Budesonide had less recurrence of hospital or ED visits. Generally, adherence to medication was poor and outcomes reflected this. Neither readmission rates nor ED visits improved with patient medication compliance.

Cavazos, G. (2006, Jul-Aug). Asthma in emergency department. Guidelines, physicians and patients. Revista Alergia Mexico, 53(4), 136 - 143.

Impact Factor: Not Available
Quality of Evidence: Limited

n=152
Retrospective study
This study was conducted in Mexico to determine reasons for high morbidity and mortality in patients with bronchial asthma. The study directly assessed collaboration between medical services including emergency, outpatient and also specialists.

Four variables investigated:
1. Number of patients who were diagnosed with bronchial asthma
2. Number of patients prescribed regular treatment with inhaled corticosteroids
3. Number of patients compliant with regular treatment with inhaled corticosteroids

4. The existence of collaboration among the different levels of medical services (emergency, outpatient and asthma specialists)

The study found that there is a lack of knowledge respecting the guidelines for treatment of asthma among emergency physicians. This lack of guideline knowledge can contribute to treatment failures and leads to patient confusion regarding recommended treatments. Strategies for implementation of international guidelines for the treatment of asthma have failed. Steps must be undertaken to facilitate compliance with evidence-based guidelines in order to reduce worldwide morbidity and mortality associated with asthma.

Children's' Health Council (2002). Few children in HUSKY A received care after an emergency visit or hospitalization for asthma. Retrieved from www.childrenshealthcouncil.org on March 28th, 2012.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
Informational Article
HUSKY(a health insurance program for qualified pediatric residents of Connecticut), data was reviewed to determine follow-up care after ED visit. It was found only 20% of patients had a follow-up appointment within 2 weeks of ED visit.

HUSKY Study: Using enrollment data for children who were seen for emergency care or hospitalized for treatment of asthma with an ICD-9 discharge diagnosis code of 493.0-493.9, were then enrolled into the trial. Health carriers were: BlueCare, Preferred One, Community Health Network, and Health Net.

The percentage of children who had ambulatory care follow-up after an emergency visit or hospitalization was determined. This information was used to establish the percentage of children who were at the greatest risk for no follow-up, and determined their profile networks. They also reviewed the odds of having had follow-up by 2 weeks, while controlling for age, gender, race, ethnicity, primary language residence and health plan. In this program, 20% of the children with visits in the Emergency Room had a follow-up office or clinic appointment within two weeks. The study showed that 41% of the children who were hospitalized had a follow-up office or clinic appointment within two weeks.

Cloutier, M. M., Hall, C. B., Wakefield, D. B., & Bailit, H. (2005). Use of asthma guidelines by primary care providers to reduce hospitalizations and emergency department visits in poor, minority, urban children. *J Pediatr, 146*(5), 591-597. doi: 10.1016/j.jpeds.2004.12.017

Impact Factor: 4.15
Quality of Evidence: Acceptable

n=3748
Cohort study
June 1998-August 2002. This study measured the impact of an "Easy Breathing™" disease management program for low income minority children with ED visits and hospitalizations. About half (48%) of these children had persistent disease, requiring use of inhaled corticosteroids. Use of the "Easy Breathing™" program increased paid claims for this inhaled

steroid by 25%. Interestingly, provider adherence of National Asthma Education Prevention Plan (NAEPP) Guidelines increased as well during the study period. The study found that the "Easy Breathing™" program decreased hospitalization rates, asthma related emergency department visits, and outpatient visits.

Collaboratives, H. H. D. (2005). Asthma: percent of patients who have had a visit to an Emergency Department (ED)/Urgent Care office for asthma in the past six months.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
National Quality Measures Clearinghouse ID 1615= Percent of asthma patients who have had a visit to an Emergency Department/ Urgent Care office for asthma, in the past six months. This measure is used to monitor the management of chronic lung disease, specifically asthma, such as use of inhaled drugs typically prescribed to asthmatic patients by the providers and review how many have uncontrolled asthma, by reviewing the number of emergency department or urgent care visits in a six month time period. Measure is not specified to pediatrics, but includes ALL patients with asthma with documented query about Emergency Department or Urgent Care visits. This measure is based on clinical guidelines. This is one of a set of eleven measures that participants track in the Health Resource Service Administration HRSA Health Disparities Collaborative for Asthma.

Courtney, A.U., McCarter, D.F., and Pollart, S.M. (2005). Childhood asthma: Treatment update. American Family Physician, 71, 1959-1969.

Impact Factor: 1.70
Quality of Evidence: Limited

n=Not Specified
Informational Article
The article summarizes the treatment of asthma in children, based upon new modalities and recent studies as of 2005. The authors conclude that education in the Emergency Department (ED) does not reduce subsequent ED care, hospitalizations or unscheduled doctor visits. However, it was determined that inhaled corticosteroids in high doses in the ED reduced readmission rates. Asthma treatment should be tailored to the severity of asthma. The goal of therapy is to reduce wheeze and cough, and reduce the risk and number of acute exacerbations.

In an acute asthma exacerbation, recommended treatments include the following:

- Inhaled beta 2 agonists
- Supplemental oxygen
- Inhaled ipratropium bromide (Atrovent)

Shown to reduce the incidence of hospital admissions:

- Oral corticosteroids administered within 45 minutes of onset of symptoms
- Inhaled corticosteroids were used

For long-term medical treatment inhaled corticosteroids are standard for maintenance therapy. Studies have shown that inhaled corticosteroids are more effective than inhaled long-acting beta

2 agonists. Some studies have demonstrated that inhaled corticosteroids provide better control than oral montelukast. Nedocromil and Cromolyn have not shown to be as effective as inhaled corticosteroids in children. The use of oral theophylline is not recommended in children because of the potential for serious side effects. Other interventions included education of parents and children. Education should include:

- Recognition and avoidance of triggers
- Understanding the use of medications, including
  - Proper dose
  - Method of administration
  - Timing of administration Treatment compliance and monitoring

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Diedhiou, A., Probst, J. C., Hardin, J. W., Martin, A. B., & Xirasagar, S. (2010). Relationship between presence of a reported medical home and emergency department use among children with asthma. *Med Care Res Rev, 67(4*), 450-475. doi: 10.1177/1077558710367735

Impact Factor: 2.96
Quality of Evidence: Acceptable

n=14,916
Cohort Study
2005-2006. National Survey of Children with Special Health Care Needs (NS-CSHCN). Reviewed NS-CSHCN to explore relationship between medical home and need for emergency care. Receiving primary care in a medical home was associated with fewer emergency department (ED) visits. The authors of the study recommended referral to local Primary Care Physicians (PCP) for those utilizing only emergency services.

The study examined the number of ED visits, and quality of ambulatory care. Children rendered care through a medical home had 7% fewer ED visits.

This study also confirmed that children in poor families are more likely to have uncontrolled asthma and rely on emergency departments as their primary source of care, due to not having physician support to manage asthma symptoms. The study suggested that one intervention for those utilizing only emergency services is to include ED physicians in a partnership with non-emergency care providers. Referrals to ambulatory care centers and to local primary care providers where they can access the services needed is recommended.

Dinakar, C., & Reddy, M. (2004, January). The Yellow Zone in Asthma Treatment: Is it a Gray Zone? Annals of Allergy, *Asthma & Immunology, 92(1),* 7-16.

Impact Factor: 2.67
Quality of Evidence: Acceptable

n=36
Review of Literature
This review was conducted to determine exacerbation frequency and usefulness of an asthma action plan, in managing exacerbations requiring hospitalization. Available literature on methods of preventing and minimizing exacerbations were reviewed to identify potential opportunities for improvement. The National Institutes of Health (NIH) guidelines support that physicians give patients written action plans with instructions on managing home (yellow zone) exacerbations.

According to the guidelines, patients enter the yellow zone when they experience an increase in asthma symptoms. At issue is that criteria used to identify the yellow zone are not clear and often are confusing to patients and care providers. Additionally, the guidelines are lacking in recommendations for yellow zone treatment strategies. The review reinforced the use of action plans, with effective strategies for patients to follow. The role of controller medication use in managing the green zone was also recognized. Translating the NIH guidelines into realistic clinical practice requires a clearer and more patient-friendly definition of the yellow zone, and this improved definition will facilitate the prescription of effective interventions in the management of yellow zone exacerbations.

Eigen, H. (2008). Differential diagnoses and treatment of wheezing and asthma in young children. *Clinical Pediatrics. 47(8),* 765-745.

Impact Factor: 1.51
Quality of Evidence: Limited

n=Not Specified
Review of Literature
The review discusses differential diagnosis and treatment in young children and provides a construct for asthma care in young children (e.g., how and when to treat, assessing asthma progression risk, etc). Diagnosing asthma in young children can be difficult due to the variation in symptoms, type, severity, and frequency of asthma signs. These variations differ among children including reporting symptoms at differing times.

Review of the following is important when caring for asthmatic children:

- When to treat
- How to treat
- Assessing the risk of asthma progression in wheeze
- Most effective controller regimen
- When to terminate controller therapy

Determination of the differential diagnosis was investigated in the very young population. The Tucson Children's Respirator Study states: Children younger than 3 years of age with frequent wheeze (e.g., >3 episodes in past year that lasted >1 day and affected sleep) are at increased risk of developing asthma if they have a positive Asthma Predictive Index (API) based on 1 risk factor (atopic dermatitis, or parent with asthma), or 2 of 3 minor risk factors (allergic rhinitis, eosinophilia, or wheezing without a cold).

Modified API=4 or more exacerbations of wheezing in 12 months, with at least 1 physician confirmed exacerbation, allergic sensitization to at least one aero allergen in the major criteria, and replaces allergic rhinitis as a minor criterion with allergic sensitization to milk ,eggs or peanuts.

Symptom variation and comorbidity of bronchitis, viral lower respiratory infection and recurrent upper respiratory tract infection, bronchopulmonary dysplasia, cystic fibrosis, congestive heart failure, and bronchiolitis make asthma difficult to diagnose early.

Establishing diagnosis is based on: frequent wheezing, family history of asthma, patient symptoms, and response to exposure allergens, and the presence of Gastroesophogeal reflux disease (GERD). The API provides a framework for diagnosis, along with pulmonary function

tests (PFT). Conversely, accuracy of PFT has been tested in preschoolers, with 85% validity, thus providing informative results.

Global Initiative for Asthma. Global strategy for asthma management and prevention. Updated 2011. (2011) Hamilton, ON: Global Initiative for Asthma. Retrieved from https://www.GINA.org.

Impact Factor: Not Available
Quality of Evidence: Limited

n=Not Specified
Guideline
In discussion of guideline development, authors noted that medication treatment and education will reduce Emergency Department visits. The authors determined there was no relationship between past visits for asthma, and frequency of future visits. The guideline did not provide a recommendation due to lack of evidence.

Gregor, M. A., Wheeler, J. R., Stanley, R. M., Mahajan, P. V., Maio, R. F., Piette, J. D., & Great Lakes Emergency Medical Services for Children Research, N. (2009). Caregiver adherence to follow-up after an emergency department visit for common pediatric illnesses: Impact on future ED use. *Med Care, 47(3),* 326-333. doi: 10.1097/MLR.0b013e3181893747

Impact Factor: 3.41
Quality of Evidence: Acceptable

n=455
Observational Study
Children presented to the emergency department (ED) with asthmatic exacerbations, and were subsequently discharged with physician recommendations for follow-up. Follow-up adherence was measured via caregiver survey. The authors concluded that primary care follow-up after the ED visit was associated with a lower rate of ED use. Caregiver lack of experience in dealing with asthma was found to lead to an increase in ED visits. The majority of the children in the study were Medicaid recipients.

Greineder, D. K., Loane, K. C., & Parks, P. (1995). Reduction in resource utilization by an asthma outreach program. *Arch Pediatr Adolesc Med, 149(4),* 415-420.

Impact Factor: Not Available
Quality of Evidence: Limited

n=53
Convenience Sample
The objective was to study the effect of an asthma outreach program impact on use of the ED or hospitalization. Emergency use was reduced after a one to one orientation visit with an asthma outreach nurse, who provided instructions on management, triggers, use of inhalers, and peak flow meters. Reduction in utilization of ED visits and hospital admission rates resulted in reduced cost of care savings.

Guilbert, T. W., Garris, C., Jhingran, P., Bonafede, M., Tomaszewski, K. J., Bonus, T., . Schatz, M. (2011). Asthma that is not well-controlled is associated with increased healthcare utilization and decreased quality of life. *J Asthma, 48(2),* 126-132. doi: 10.3109/02770903.2010.535879

Impact Factor: 1.53
Quality of Evidence: Acceptable

n=170
One year prospective longitudinal survey
The purpose of the study was to review asthma control and the health-related quality of life (HRQL), in addition to resource use. Quality of life is assumed to increase as asthma is controlled. Asthma control was measured by the Childhood Asthma Control Test (C-ACT). Scores were dichotomized into "well controlled," or "not well controlled" and measured using the Peds HRQL 3.0 Asthma Module. Children whose asthma was not well controlled were found to have lower quality of life scores. Children with asthma that was not well controlled had a fivefold increased risk for a visit to a physician or Emergency Department.

ICSI. (2010). Diagnosis and management of asthma: percentage of controlled asthma patients who are seen by a health care provider every one to six months.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
Outcome Measure
National Quality Measure Clearinghouse ID 6179= Diagnosis and management of asthma: percentage of controlled asthma patients who are seen by a health care provider every one to six months.

This measure is used to assess the percentage of patients with asthma who are seen by the provider every one to six months, inferring uncontrolled asthma. The numerator displays the number of patients age 5 and up, who are seen by the provider for treatment of asthma, the denominator displays all those patients who are controlled (with inclusions/exclusions). Controlled asthma is determined by ICD 9 codes, used to query all asthma diagnoses to populate the measure.

ICSI. (2010). Diagnosis and management of asthma: percentage of patients with asthma who return to the emergency department (ED) for treatment of asthma within 30 days of last visit to the ED.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
Outcome Measure
National Quality Measures Clearinghouse ID 6177=Diagnosis and management of asthma: percentage of patients with asthma who return to the emergency department (ED) for treatment of asthma within 30 days of last visit to the ED.

The numerator for the measure is numbers of patients age 5 and older, who are readmitted to the hospital within 30 days of discharge. The denominator is all patients age 5 and older, who were discharged from the ED with an asthma diagnostic code. The International Classification of Diseases and related health problems (ICD-9 codes) are used to query asthma patients with diagnoses to populate the measure.

Lara, M., Duan, N., Sherbourne, C., Halfon, N., Leibowitz, A., & Brook, R. H. (2003). Children's use of emergency departments for asthma: persistent barriers or acute need? *J Asthma, 40(3),* 289-299.

Impact Factor: 1.53
Quality of Evidence: Acceptable

n=234
Non-Randomized Controlled Trial
Mid-May 1995 - November 1995. In a study limited to the Latino inner city population, the objective was to determine the acute need for ED services, the reasons why Latino children do not receive adequate care prior to the ED visit, and the reason for the ED visit (i.e., truly worsening of symptoms versus perceived barriers to receiving primary care). It was found that children who used the ED did not utilize primary care, however, it was determined that the reason the parents take the children to the ED was due to the severity of the presenting symptoms. Less than 25% of parents reported a delay of care related to insurance or payment. The need for ED services in this area was found to be justified due to the number of children seen in the ED with moderate to severe exacerbations of asthma based on use of the NHLBI criteria.

Leickly, F. E., Wade, S. L., Crain, E., Kruszon-Moran, D., Wright, E. C., & Evans, R., 3rd. (1998). Self-reported adherence, management behavior, and barriers to care after an emergency department visit by inner city children with asthma. *Pediatrics, 101(5),* E8.

Impact Factor 4.47
Quality of Evidence: Acceptable

n=344
Non Randomized Control Trial
The National Cooperative Inner-City Asthma Study aimed to explore adherence to care. Issues that adversely affected adherence to the asthma care program were identified. Patients presenting to the ED were enrolled into the study. Baseline interviews were conducted 3 to 5 weeks after the ED visit, as well as medical record chart extraction for additional information. Four common themes were identified that affect adherence; medicine use, appointment-keeping, emergency actions, and asthma attack prevention. Beta agonist and steroid use was examined most often. Unknown side effects of the medication were reported most often as the reason for non adherence in this population. Other themes identified were doubts regarding usefulness of medication, forgetting medication dosages, or children manipulating parents to not take medications. Only a small number of patients' were able to verbalize avoidance of triggers, and report regular use of preventative medications.

Mansour, M. E. (2009). How do we support follow-up with the primary care provider after an emergency department visit for asthma? *Pediatrics, 124(4),* 1206-1207. doi: 10.1542/peds.2009-1284

Impact Factor: 4.47
Quality of Evidence: Limited

n=Not Specified
Informational Article
The article examined a study regarding two research questions 1) Why urban children seek care in the ED, and not primary care, and 2) How the medical community can ensure follow-up care after the ED visit with a collaborative process. The authors believe that if these concepts are understood, interventions can change the healthcare system by improved interactions, improved outcomes for children and eventually reduce health care costs. This study focused on parental health beliefs, rather than provider or financial capabilities. Patients were included in a new care model utilizing a care manager to educate and encourage a change in behavior for parents who previously sought only the ED for assistance.

The care manager focused on these topics of self management education:

- Barriers to seeking healthcare follow-up
- Health beliefs, readiness to change
- Confidence
- Knowledge of available resources
- Trusting relationship with care provider

National Center for Heart Lung and Blood Institute. (2007). National Asthma Education and Prevention Program Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma Full Report. United States Department of Health and Human Services. Retrieved April 6, 2012, from http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
Guideline
The authors noted that the strongest indicators or predictor of future severe exacerbations, leading to ED visits and hospitalizations were frequency of the asthmatic episodes, the rate of onset and the severity or cause of exacerbations. (Adams et al, 2000, Eisner et al. 2001; Ford et al. 2001; Lieu, et al. 1998).

Sin, D. D., Bell, N. R., & Man, S. F. (2004). Effects of Increased Primary Care Access on Process of Care and Health Outcomes among Patients with Asthma Who Frequent Emergency Departments. *The American Journal of Medicine , 117 (7),* 479-483.

Impact Factor: 5.43
Quality of Evidence: Acceptable

n=125
Non Randomized Control Trial
Study conducted to determine the effectiveness of a health professional based intervention on improving process of care and outcomes among asthmatic patients seen in the emergency department. The care process was enhanced by using a study coordinator who offered to make

the follow-up appointment directly with the patient's physician. The findings suggest that this intervention improved the rates of asthmatic patient follow-up visits after emergency department visit. The increase in the frequency of follow-up visits was associated with a statistically significant and clinically meaningful improvement in health-related quality of life. The patients assigned to the enhanced process of care were more likely to have written action plans and peak expiratory flow meters for their asthma at 6 month follow-up. Unfortunately, the study found that improvements in the process of care disappeared by 12 months of follow-up, suggesting that the beneficial effects of this intervention are time-limited. The study identified that further reinforcement of care patterns would be needed to maintain sustained outcomes.

Spurrier, N. J., Staugas, R., Sawyer, M. G., Wakefield, M. A., Ruffin, R. E., Jureidini, J., Baghurst, P. (2003). Health-service use by children with asthma over a 6-month period. *J Paediatr Child Health, 39(1),* 15-21.

Impact Factor: 1.28
Quality of Evidence: Acceptable

n=135
Participant Study
Study period 1997
This was a descriptive study to analyze what health services are used by pediatric asthmatic patients. Children with asthma had more visits to both their primary care practitioner, in addition to utilization of as hospital services. Different variables predicted unplanned care in both primary care, as well as the ER. The ED assessment was in a South Australian metropolitan community. Variables for utilization of services were categorized into disease related, parental related, or related to socio-demographics.

The study found that a far larger proportion of children made unplanned visits to their primary care practitioners than the emergency room. Enhanced hours of service in the primary practice setting reduced ER visits.

The findings of the study further demonstrated the need to assure that the primary care office is readily staffed to undertake this asthmatic population, as well as being familiar and educated in the best care practices. Parents stated that primary care practitioners were more easily accessible for this study.

Teach, S. J., Crain, E. F., Quint, D. M., Hylan, M. L., & Joseph, J. G. (2006). Improved asthma outcomes in a high-morbidity pediatric population: results of an emergency department-based randomized clinical trial. *Arch Pediatr Adolesc Med, 160(5),* 535-541. doi: 10.1001/archpedi.160.5.535

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=488
Prospective Randomized Clinical Trial-Convenience Sample
The outcome measured was the rate of unscheduled visits for asthma, as well as reviewing secondary outcomes of compliance with a medical plan and the reported quality of life. The assumed improvement for overuse of the ED is to reduce ED visits by increasing follow-up with primary care. However, traditionally this has not shown to decrease unscheduled visits. This study created the asthma clinic inside the ED, to provide interventions on three domains:

asthma self monitoring and management, environmental modification and trigger control, and linkages and referrals to ongoing primary care. Assumptions were that these interventions would increase management of asthma and eventually quality of life.

Success with this program was related to many factors:

- Teachable moments
- Trigger avoidance
- Motivated participants
- Comprehensive teaching
- Patient/Family centeredness
- Medication use

Utilization of the ED will remain high in facilities that do not have the benefit of an asthmatic center. Attendance in the clinic was high, and evidence was provided that decreased incidence of severity of unscheduled asthmatic visits to the ED.

Teach, S. J., Guagliardo, M. F., Crain, E. F., McCarter, R. J., Quint, D. M., Shao, C., & Joseph, J. G. (2006). Spatial accessibility of primary care pediatric services in an urban environment: association with asthma management and outcome. *Pediatrics, 117(4 Pt 2),* S78-85. doi: 10.1542/peds.2005-2000E

Impact Factor: 4.47
Quality of Evidence: Acceptable

n=411
Convenience Sample
Spatial Accessibility of Primary Care Pediatric Service in an Urban Environment: Association with Asthma Management and Outcome. Spatial accessibility was noted to be important due to the general acknowledgement that accessibility to care impacts health outcomes, such as frequency of visits to the emergency room. Geographic locality of participants was analyzed, as well as sociological demographics. This was relevant to the hypothesis that spatial access to primary care should facilitate more visits, and thereby improve health outcomes. Analysis controlled for external factors related to insurance, comorbidity, severity of chronic illness and home exposures known to impact asthma morbidity. Results determined that spatial accessibility to primary care pediatric services was associated with an increased likelihood of scheduled primary care visits for asthma in the past 12 months.

Zorc, J. J., Scarfone, R. J., & Li, Y. (2005). Predictors of primary care follow-up after a pediatric emergency visit for asthma. *J Asthma, 42(7),* 571-576. doi: 10.1080/02770900500215947

Impact Factor: 1.53
Quality of Evidence: Limited

n=278
Informational Article
As part of a previous trial, parents of asthmatic patients were surveyed after discharge from the ED. Barriers to making the PCP follow-up visit were analyzed. Baseline factors that affected the follow-up visit included recent hospitalization, more than one previous ED visit, parental assessment of severity of asthma, and current daily use of the controller medication. The

authors found that parent beliefs regarding their child's asthma was a strong indicator in PCP follow-up.

Zorc, J. J., Scarfone, R. J., Li, Y., Hong, T., Harmelin, M., Grunstein, L., . . . Randomized, t. (2003). Scheduled follow-up after a pediatric emergency department visit for asthma: a randomized trial. *Pediatrics, 111(3),* 495-502.

Impact Factor: 4.47
Quality of Evidence: Limited

n=278
Randomized Convenience Sample
Children who were treated in the ED after an asthmatic event were enrolled, to evaluate follow-up with their PCP within three to five days. Intervention subjects were assisted to call their PCP from the ED and schedule the follow-up appointment. If an appointment could not be scheduled, ED staff continued to provide assistance to ensure that the appointment was confirmed. Medication use was analyzed. No difference was seen in return visits to the ED. The median time of the visit for the PCP was shorter in the intervention group. No further outcomes were assessed.

III. Research Question 2
Who is primarily providing asthma care?
Do the characteristics of the person providing the care influence outcomes?

Summary

There have been studies that have shown that asthmatic children who use the emergency department as their primary source of care for asthma are not receiving appropriate management. The National Heart Lung and Blood Institute (2007) authors found that multidisciplinary asthma disease- management showed improvement in several cases, and emergency services and hospitalizations were reduced when multidisciplinary care was utilized.

This literature review found evidence of multiple types of care providers who manage pediatric asthma patients in the United States, along with other parts of the world. The use of primary care providers, nurse practitioners, registered nurses, community health workers, and home visits, are all found to be effective providers for the management of pediatric asthmatic patients. It was also shown that outreach programs, school-based programs and asthma centers were effective in the management of asthma through improved outcomes of asthmatic children.

Use of multiple providers in managing asthma patients is an efficient way to educate patients, parents and healthcare providers, in addition to providing the personal management that is needed to control this wide spreading chronic disease affecting children. However, even with multiple providers in place, there continues to be significant use of the emergency department (ED) as a location for primary asthma care in the pediatric population (National Center for Heart Lung and Blood Institute, 2007). Cost analysis and quality improvements have determined that the Emergency Room (ER) is not the ideal way to manage care for asthmatic children (Bielory & Goldberg, 1996).

Fredrickson et al., (2004), found that the mothers of Medicaid-insured asthmatic children, who visit the ER for asthma treatment, did so because of barriers they encountered in the primary care setting. Barriers were described as:

- Difficulty in obtaining urgent or convenient appointment
- Limited continuity of care
- Problems with after-hours coverage
- Lack of standardized, agreed management protocols and case management
- Inattention to preventive measures
- Difficulty obtaining medications.

Koné et al., (2007), showed that one month after an asthmatic child had an emergency department visit, 52%, or 267 children did not have a primary care physician to follow-up with. These children were followed for one year, and it was determined that children without a primary care physician (PCP) had at least one other ED visit, and were less likely to have overall asthma control. Analysis of the data estimated that even when outside factors are controlled, the impact of not having a PCP still remained to be the trigger for repeat emergency room care.

<u>Asthma Care Centers</u>

The use of asthma centers, asthma outreach programs, or school based centers as a source of asthma care and management is found in those patient populations who have less access to

care. These centers and programs consist of a variety of personnel ranging from nurses, nurse practitioners, community health workers, and/or pediatricians. The interventions implemented by some of the programs and centers have revealed decreases in asthma-related hospitalizations, emergency room visits for asthma, hospital admissions, clinic visits for treatment of acute exacerbations, less days absent from school (Newcomb, 2006, Bentley et al., 2005, and Velsor-Friedrich et al., 2005).

Battleman et al., (2001) found that children, who used an asthma center instead of the emergency department, were more likely to use maintenance anti-inflammatory medications, use medications at school, have reduced frequency of emergency department visits and have less school absences.

Home Visit and Community Health Workers

There are also studies that show that home visitors and community health workers are effective in providing care, education, and management to asthmatic children and their families. Bryant-Stephens and Li, (2008) showed the use of home visitors and lay educators effectively reduced hospitalizations, emergency room visits, sick visits and asthma symptoms. Potsma et al., (2009) performed a systematic review that concluded that community health workers, who delivered interventions, resulted in improved outcomes such as, decreased asthma symptoms, daytime activity limitations, and emergency and urgent care use.

Registered Nurse

Greineder et al., (1995) assessed the effect of an asthma outreach program on emergency ward and hospital utilization for patients, aged one to 17 years, before and after entry into the asthma outreach program. The intervention consisted of a consult with an asthma outreach nurse who provided instruction in asthma management, medications, triggers, and use of inhalers and peak flow meters. The patient was also provided an individualized treatment plan by a nurse, primary care pediatrician, and if needed an allergist. The results demonstrated that patients involved in an asthma outreach program have less use of emergency wards (79% reduction) and hospital admissions (86% reduction).

Many times in the asthma programs and centers it is registered nurses (RN) that are providing the asthma education and management. A study by Kuethe et al., (2011) evaluated whether stable asthmatic children's care is inferiorly affected when managed by an asthma nurse, pediatrician or general practitioner.

The study's results demonstrated that RN’s managed the asthmatic children just as well as the pediatricians, or general practioners. Effects of poor management were not seen in those children who were managed by a hospital-based specialized asthma nurse, when compared to those children managed by a general practitioner or pediatrician. Outcomes measured included no difference in the findings between the three groups in lung function parameters, asthma control parameters, exacerbations, and school absences. Interestingly, the study found that the general practitioner group had less planned follow-up visits than the pediatrician and specialized asthma nurse groups.

Additionally, Forshee et al., (1998) performed a study that included adults, as well as asthmatic children. It demonstrated that a nurse champion program which consisted of one-on-one education and follow-up assessments can decrease missed school days, urgent care utilization, and hospital admissions, as well as increase preventative care.

General Practitioners

This literature review found improved asthma management, and outcomes with the use of General Practitioners. Glasglow et al., (2003)'s study demonstrated that when General Practitioners use the Australian developed 3+ plan, along with proactive asthma appointments, there was a level of improved asthma control and management.

Asthma Care Specialists

Asthma treated and managed by an asthma specialist has been shown to improve outcomes with asthma patients, as well as reduce the costs of the disease. The outcomes include a decrease in hospitalization, reduction in length of hospital stays, decrease in emergency room visits, decrease in number of sick care office visits, decrease in missed work or school, increase in productivity, and increase in satisfaction with care and disease management.

This literature review examined the different types of providers, and healthcare environments that traditionally manage the pediatric asthmatic patient population here in the United States and other parts of the world. Multiple providers such as Asthma Specialists, Allergist, General Practicioners, Pediatricians, Advance Practice Nurses, Registered Nurses and Community Healthcare Workers were all found to effectively manage pediatric care. However, the evidence is not clear as to why there continues to be an overwhelming amount of children who rely on the emergency department for their asthmatic care. The evidence does suggest that the use of other health care providers, entitities, and programs can provide beneficial education, care, and management of pediatric asthma. Specifically asthma educational programs and practices appear to have a seminal role in the reduction of asthma symptoms and improving confidence in management by parents and children; futhermore it seems to be beneficial for those children who may have less access to care.

Bibliography

Adler, R., & McBride, J. (2010). Tools and Strategies for Improving Asthma Management. *Family Practice Management*, 16-21.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
Guideline
Assessing compliance with asthma guidelines is reviewed by Adler and McBride in this document. During an audit of 100 charts, it was determined that many asthma patients are not seen by their primary care providers during emergent episodic events. Part time status of the providers decreased continuity of care for the asthmatic patients. This contributed to poor follow-up and further fragmented the care, causing a decrease in adherence to guideline recommendations of care. Further cascading events found were: poor notes regarding the urgent visits and lack of a current treatment plans.

Recommendations for the care of asthmatic patients were to alter provider habits of care by further enhancing adherence to guideline managed care. These included: internal chart audits, improved diagnostic tools, committed nursing staff, chart reminders, patient self assessment plans, patient identification by ICD-9 codes, and improved technique and frequency of provider documentation.

Battleman, D. S., Callahan, M. A., Silber, S., Munoz, C. I., Santiago, L., Abularrage, J., & Jabbar, H. (2001). Dedicated asthma center improves the quality of care and resource utilization for pediatric asthma: a multicenter study. *Acad Emerg Med, 8*(7), 709-715.

Impact Factor: 1.86
Quality of Evidence: Acceptable

n=Not Specified
Retrospective Case
The purpose of this study was to evaluate the relative effectiveness of pediatric asthma care among patients treated by an asthma center versus children who use the emergency department as a site of primary asthma care. It was found that asthma center patients were more likely to use maintenance anti-inflammatory medications (60.2% versus 22.5%), more likely to take medications at school (71.4% versus 48.1%), frequency of emergency department visits were less (9.2% versus 22.0%) and had less school absences.

The study noted from another reference that certain factors were associated with inadequate medication therapy, such as age less than five years old, Medicaid insurance, and Spanish language.

Bentley, J. M., Ludlow, T., Meier, K., & Baydala, L. (2005). A community-based approach to pediatric asthma education. *Canadian Journal of Respiratory Therapy, 41*(5), 24-29.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=398
The patients were 0 to 16 years of age and were seen by a pediatrician and respiratory therapist, or registered nurse who were specifically trained in asthma education. The intervention consisted of an initial one hour education session, development of an action plan, and follow-up visits at one and six months. The data was collected via questionnaire. The results of the questionnaire demonstrated a decrease of 73.6% fewer visits to a family physician over the previous six month period; there was a decrease by 90% and 91.7%, respectively, in urgent visits to the family physician and asthma specialist; there was an 80% decrease in emergency room visits; there was a decrease of 83.3% in hospital admissions when the action plan was used. The results also yielded a 54.5% reduction in wheezing, shortness of breath, coughing and chest tightness after enrollment and participation in the asthma program. It was also noted an improvement in quality of life in regards to strenuous activities, moderate activates, and social activities. This Misericordia Community Asthma Education Program reduced total number of visits, urgent visits to family physician, and emergency room visits in a 6-month study period; hospital admissions and urgent visits to specialists were also reduced..

Bielory, L., & Goldberg, R. (1996). Cost-effective treatment of asthma. *N J Med, 93*(3), 168-170.

Impact Factor: Not Available
Quality of Evidence: Limited

n=Not Specified
Informational Article

Asthma treated and managed by an asthma specialist has been shown to improve outcomes with asthma patients, as well as reduce the costs of the disease. The outcomes include a decrease in hospitalization, reduction in length of hospital stays, decrease in emergency room visits, decrease in number of sick care office visits, decrease in missed work or school, increase in productivity, and increase in satisfaction with care and disease management.

Bryant-Stephens, T., & Li, Y. (2008). Outcomes of a home-based environmental remediation for urban children with asthma. *J Natl Med Assoc, 100*(3), 306-316.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=281
Prospective, Randomized controlled trial
The study assessed the effectiveness of a low-cost general intervention. The interventions consisted of home visitors providing asthma education and allergen avoidance measures to be applied in the home. The outcomes assessed were length of hospital stay, number of emergency visits and number of sick visits; secondary outcomes were symptom frequency, medication management and trigger reduction. The home visits and interventions were provided by lay educators and home visitors. The interventions implemented consisted of either a home visit only, or home visit with environmental remediation. The study demonstrated that both intervention groups were effective in reducing hospitalizations, emergency room visits, sick visits and asthma symptoms. Overall the study showed in-home education and environmental remediation provided by lay educators/home visitors can improve outcomes for children with asthma.

Cabana, M. D. (2005). Improving care for asthma. *J Pediatr, 147*(3), 411-412; author reply 412-413. doi: 10.1016/j.jpeds.2005.03.017

Impact Factor: 5.44
Quality of Evidence: Limited

n=Not Specified
Letter to the Editor
Commentary about a paper written by Smith et al., (2004), titled Improving follow-up for children with asthma after an acute emergency department visit. Cabana comments that Smith et al. provided an intervention that was effective in improving patient symptoms; however, it was only demonstrated to be effective for 15 days post-ED visit. He goes on to elaborate that the study highlights the importance and responsibility of PCPs "in helping sustain asthma education efforts initiated in the ED or other settings."

Chang, A. B., Taylor, B., Masters, I. B., Laifoo, Y., & Brown, A. D. (2011). Indigenous healthcare worker involvement for Indigenous adults and children with asthma (Review). *The Cochrane Collaboration*.

Impact Factor: 5.72
Quality of Evidence: Limited

n=113
Cochrane Review, RCTs=1

The review focused on whether or not the involvement of an indigenous healthcare worker in asthma education programs improved asthma outcomes in indigenous children and adults. The one randomized control trial that was analyzed demonstrated that the involvement of an indigenous healthcare worker in asthma programs was beneficial for asthma outcomes, such as days absent from school, parents' asthma skill score and parents' asthma knowledge score. However, there was no difference in asthma exacerbations.

Cyr, M. C., Martens, A. C., Berbiche, D., Perreault, S., & Blais, L. (2006). Continuity of care in the ambulatory treatment of adolescents with asthma. *J Adolesc Health, 39*(6), 926 e911-927. doi: 10.1016/j.jadohealth.2006.06.013

Impact Factor: 3.33
Quality of Evidence: Limited

n=5586
Cohort Study
The study assessed the continuity of care among adolescents with asthma in Quebec. The study demonstrated that there was a low level of continuity of care among adolescents, which was associated with a higher risk of emergency department visits and hospitalizations for asthma.

Finkelstein, J. A., Lozano, P., Fuhlbrigge, A. L., Carey, V. J., Inui, T. S., Soumerai, S. B., . . . Pediatric Asthma Care Patient Outcomes Research, T. (2005). Practice-level effects of interventions to improve asthma care in primary care settings: the Pediatric Asthma Care Patient Outcomes Research Team. *Health Serv Res, 40*(6 Pt 1), 1737-1757. doi: 10.1111/j.1475-6773.2005.00451.x

Impact Factor: Not Available
Quality of Evidence: Limited

n=638
Previously Completed Randomized Trial
This article focused on two different approaches to improve asthma care in primary care settings. The first approach involved peer leader education and the second approach involved peer leaders, but also had an asthma nurse educator which was also called the planned asthma care intervention. This analysis focused on three components, one of particular interest assessed the effect of both interventions on medical care utilization, including hospital-based and ambulatory visits. The data demonstrated that both intervention groups had improved rates of ambulatory visits in the first year and second year, but there was less of a difference in the effect of the intervention on ambulatory visits.

Forshee, J. D., Whalen, E. B., Hackel, R., Butt, L. T., Smeltzer, P. A., Martin, J., . . . Buchner, D. A. (1998). The effectiveness of one-on-one nurse education on the outcomes of high-risk adult and pediatric patients with asthma. *Manag Care Interface, 11*(12), 82-92.

Impact Factor: Not Available
Quality of Evidence: Limited

n=201
Convenience Sample Trial

The study assessed adult and pediatric asthma patients that were considered to be high risk who were enrolled in an asthma self-management program. The program consisted of nurse to patient education and follow-up sessions which assessed asthma outcomes using the Asthma Quality Assessment System questionnaire. The results of this study demonstrated that one-on-one education by a nurse champion was related to a reduction in the number of physician's office visits for urgent care, the number of emergency room visits, and the number of hospital admissions for acute asthma exacerbations. However, there was an increase in the number of physician office visits for routine care and referrals to specialists.

Fredrickson, D. D., Molgaard, C. A., Dismuke, S. E., Schukman, J. S., & Walling, A. (2004). Understanding frequent emergency room use by Medicaid-insured children with asthma: a combined quantitative and qualitative study. *J Am Board Fam Pract, 17*(2), 96-100.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=2726
Informational Article
The study used billing data and focus groups to clarify the reasons for frequent emergency room use by Medicaid-insured children (aged 0 to 17 years) with asthma, living in rural areas and 23 towns in Kansas. The study concluded that emergency room visits for this identified population was driven by problems in using primary care services. The mothers of the asthmatic children who visit the ER for asthma treatment were interested "in preventative measures, case management approaches, and increased use of primary care to manage their children's asthma." However, there are barriers these mothers have encountered which limit the management of the children's asthma in primary care. These barriers include "difficulty in obtaining urgent or convenient appointment, limited continuity of care, problems with after-hours coverage, lack of standardized management protocols, case management, inattention to preventive measures," and difficulty obtaining medications. The article noted that mothers reported encouragement of emergency room use by the primary care physicians or office staff members. Overall, this study highlighted the fact that in order to reduce emergency room use by Medicaid-insured asthmatic children these barriers need to be dissolved by way of "attention to aspects of practice organization, introduction of standardized management protocols, use of case managers, and attention to preventive measures."

Global Initiative for Asthma. Global strategy for asthma management and prevention. Updated 2011. (2011) Hamilton, ON: Global Initiative for Asthma. Retrieved from https://www.GINA.org.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n= Not Specified
Guideline
The GINA Board of Directors recognizes the difficulty of the challenge for care providers, especially primary health care providers, and public health officials in various capacities affecting the publics' health, to design, implement, and evaluate quality asthma programs to meet their local needs. Consistency in practice of recommended care reflecting the use of guidelines are encouraged. There is sufficient date globally to conclude that the burden of asthma care needs can be reduced through patient and parent efforts, health care providers, healthcare organizations, and local and national governments, and those who are providing the

closest contact and care. In this global initiative, acute asthmatic patients are directed to the "Nearest clinic or hospital that provides emergency access."

Glasgow, N. J., Ponsonby, A. L., Yates, R., Beilby, J., & Dugdale, P. (2003). Proactive asthma care in childhood: general practice based randomised controlled trial. *BMJ, 327*(7416), 659. doi: 10.1136/bmj.327.7416.659

Impact Factor: 13.66
Quality of Evidence: Acceptable

n=174
Randomized Controlled Trial with Cluster Sampling by General Practice
The study evaluated, children with moderate to severe asthma, and the effectiveness of the 3+ plan in conjunction with active recall in the proactive asthma management in children based in a general practice setting. The study assessed process measures such as "rates for asthma consultations with general practitioner, written asthma plans, completion of the 3 + visit plan."

The clinical measures evaluated:

- Rates for emergency department visits for asthma
- Days absent from school
- Symptom-free days
- Symptoms over the past year
- Activity limitation over the past year
- Asthma drug use over the past year
- Spirometric lung function measures before and after cold air challenge

The results demonstrated that the intervention group was more likely to complete the 3+ plan, an intervention used by general practitioners, increased use of the asthma action plan; furthermore the intervention children experienced a statistically significant, but not clinically significant reduction in measurement of the Fixed Expiratory Volume (FEV_1) to the cold air challenge. There was a reduction in speech-limiting wheezing and visits to the emergency department among the intervention children, these had notable changes but were not considered to be significant. Overall the study highlighted that general practice based proactive asthma care in children with moderate to severe asthma can be advantageous.

Greineder, D. K., Loane, K. C., & Parks, P. (1995). Reduction in resource utilization by an asthma outreach program. *Arch Pediatr Adolesc Med, 149*(4), 415-420.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=53
Before and After Trial
This study assessed the effect of an asthma outreach program on emergency ward and hospital utilization for patients, aged 1 to 17 years, before and after entry into the asthma outreach program. The intervention consisted of a consult with an asthma outreach nurse who provided instruction in asthma management, medications, triggers, and use of inhalers and peak flowmeters. "An individualized step-care treatment program was outlined for each patient by the nurse, primary care pediatrician, and when appropriates, an allergist. The outreach nurse maintained personal or telephone contact with the families on a regular basis to assure

understanding of and compliance with the treatment plan." The program was implemented by one nurse. The results demonstrated that patients involved in an asthma outreach program have less use of emergency wards (79% reduction) and hospital admissions (86% reduction).

Hospital-based asthma program targets physician education to reduce pediatric ER visits. (1999). *Healthc Demand Dis Manag, 5*(7), 104-107.

Impact Factor: Not Available
Quality of Evidence: Limited

n=Not Specified
Informational Article
This article addressed a hospital-based disease management program in a pediatric hospital in Atlanta which was implemented in order to reduce pediatric emergency room visits. This program focused on educating physicians on how to management asthma and how to educate the children and parents about self-management. The first year of this program produced an 85% decrease in emergency room visits and a 78% decrease in unscheduled hospital admissions. It was also noted that in the "first six months of the program, physician use of the evidence-based practice guideline increased from 29% to 70%."

The article also noted that six core outcome measures were identified which were based on literature searches and physician input, these were:

- reduced annual hospitalization rates
- shorter average length of stay for admitted patients
- reduced number of annual emergency room visits
- lower rate of school absenteeism
- lower rate of parent absence from work due to child's asthma
- Improved quality of life

These measures were collected by parent reporting using a multiple choice questionnaire.

Klinnert, M. D., Liu, A. H., Pearson, M. R., Ellison, M. C., Budhiraja, N., & Robinson, J. L. (2005). Short-term impact of a randomized multifaceted intervention for wheezing infants in low-income families. *Arch Pediatr Adolesc Med, 159*(1), 75-82. doi: 10.1001/archpedi.159.1.75

Impact Factor: Not Available
Quality of Evidence: Limited

n=150
Randomized Multifaceted Intervention
The study included at risk infants aged 9 to 24 months with three or more physician-documented wheezing episodes and at risk for childhood asthma and focused on the effect of a home-based intervention with low-income caregivers. The Childhood Asthma Prevention Study intervention consisted of nurse home visitors which worked to reduce environmental tobacco smoke and indoor allergen exposures, as well as maternal caregiving (asthma management and emotional caregiving) over a one year time span. The intervention was successful in the reduction of several environmental exposures, such as tobacco smoke and cockroach infestation, and improving the "caregiver's awareness of their infants' breathing problems and to

impress on them the importance of bringing those problems to the attention of medical care professionals and following recommendations."

Koné, A. J., Rivard, M., & Laurier, C. (2007). Impact of follow-up by the primary care or specialist physician on pediatric asthma outcomes after an emergency department visit: the case of Montreal, Canada. *Pediatric Asthma, Allergy & Immunology, 20*(1), 23-35.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=267
Non Randomized Controlled Trial
Convenience sample with telephone survey were used to assess follow-up practices subsequent to an emergency visit for asthma. Survey was conducted with parents of children ages 1-14 years 3-5 days after discharge from the emergency room. Results indicated that one month after the ED visit, 52%, or 267 children did not have a primary care physician to follow-up with. The children were followed for one year, and it was determined that children without a PCP had at least one other ED visit, and were less likely to have overall asthma control. When interviewed, parents stated three reasons why they did not have a PCP; those were the possibility of using the hospital emergency room, their child did not have regular asthma, or their child had not yet had another asthma attack. Analysis of the data estimated that even when outside factors are controlled, the impact of not having the PCP still remained to be the trigger for repeat emergency room care. Limitations were listed as sample was only taken from the initial ED visit and not community or population wide.

Kuethe, M., Vaessen-Verberne, A., Mulder, P., Bindels, P., & van Aalderen, W. (2011). Paediatric asthma outpatient care by asthma nurse, paediatrician or general practitioner: randomised controlled trial with two-year follow-up. *Prim Care Respir J, 20*(1), 84-91. doi: 10.4104/pcrj.2011.00003

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=107
Randomized Controlled Trial
The study evaluated whether stable asthmatic children's care is inferiorly effected when managed by an asthma nurse, pediatrician or general practitioner. The study's results demonstrated that asthmatic children, between the ages of 6 and 16, can be managed by a hospital-based specialized asthma nurse and asthma control will not be poorly effected when compared to management by a general practitioner or pediatrician. The results did not indicate any difference between the three groups when lung function parameters, asthma control parameters, exacerbations, and school absences were compared. The only difference noted was that the general practitioner group had less planned follow-up visits than the pediatrician and specialized asthma nurse groups. Overall, this study highlighted that the outpatient management by a specialized asthma nurse is not less or substandard in comparison to the management of a general practitioner or pediatrician.

National Quality Measures, C.). Asthma: average number of symptom-free days in the previous two weeks Retrieved 11/13/2012, from

http://www.qualitymeasures.ahrq.gov/content.aspx?id=27596&search=asthma+and+(child+or+children)

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
Measure
National Quality Measure Clearinghouse ID 1612= Asthma: Average number of symptom-free days in the previous two weeks. This measure is used to assess the average days that patients are symptom free in the previous two weeks among patients with asthma who report symptom-free days. Symptom free days include lack of daytime coughing, wheezing, shortness of breath, chest tightness, night time coughing and wheezing. Days are defined as 24 hour periods covering both night time and day time. This measure is not specified to pediatrics. The numerator is the number of symptom free days, no exclusions are specified. This measure is primarily used in the ambulatory/office based care and community health care. Initial populations are from patient's associated with the provider participating in the measure. Providers are defined as Advanced Practice Nurses, Physicians Assistants and Physicians.

National Quality Measures, C.). Asthma: percent of patients who have had a visit to an Emergency Department (ED)/Urgent Care office for asthma in the past six months Retrieved 11/13/2012, from http://www.qualitymeasures.ahrq.gov/content.aspx?id=27599&search=asthma+and+(child+or+children)

Impact Factor: Not Available
Quality of Evidence: Limited

n=Not Specified
Measure
National Quality Measure Clearinghouse ID 1615=Asthma: Percent of patients who have had a visit to an Emergency Department/ Urgent Care office for asthma, in the past six months. This measure is used to assess the management of chronic lung disease, specifically asthma, such as use of inhaled drugs. Measure is not specified to pediatrics, but includes ALL patients with asthma with documented query about Emergency Department or Urgent Care visits. This measure is based on clinical guidelines. This is one of a set of eleven measures that participants track in the Health Resource Service Administration (HRSA) Health Disparities Collaborative for Asthma.

National Quality Measures, C.). Diagnosis and management of asthma: percentage of controlled asthma patients who are seen by a health care provider every one to six months Retrieved 11/13/2012, from http://www.qualitymeasures.ahrq.gov/content.aspx?id=27697&search=asthma+and+(child+or+children)

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
Measure
National Quality Measure Clearinghouse ID 6179= Diagnosis and management of asthma:

percentage of controlled asthma patients who are seen by a health care provider every one to six months. This measure is reviewing all the participating providers' asthmatic population who are ages five and older and who are controlled as identified by ICD-9 codes. The numerator includes controlled asthma patients, seen by a provider every one to six months. No exclusions are specified.

National Quality Measures, C.). Diagnosis and management of asthma: percentage of patients who are uncontrolled or have change in medication or clinical status, who are seen by a health care provider within two to six weeks Retrieved 11/13/2012, from http://www.qualitymeasures.ahrq.gov/content.aspx?id=27696&search=asthma+and+(child+or+children)

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
Measure
National Quality Measure Clearinghouse ID 6178= Diagnosis and management of asthma: percentage of patients who are uncontrolled or have change in medication or clinical status, who are seen by a health care provider within two to six weeks. Patient identification is done by ICD-9 code, for uncontrolled asthma ages five and older. The numerator includes those patients who are uncontrolled or have had a change in medication, or clinical status and were seen by the provider in the acceptable time frame of six weeks.

Nelson, K. A., Highstein, G. R., Garbutt, J., Trinkaus, K., Fisher, E. B., Smith, S. R., & Strunk, R. C. (2011). A randomized controlled trial of parental asthma coaching to improve outcomes among urban minority children. *Arch Pediatr Adolesc Med, 165*(6), 520-526. doi: 10.1001/archpediatrics.2011.57

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=241
Randomized Controlled Trial
The study assessed if asthma coaching decreased emergency department visits and hospitalizations, as well as increase the number of outpatient asthma monitoring visits. The intervention occurred over an 18 month time span. There were two groups the usual care group (control group) and the parental coached group. The parental coached group focused on interventions related to asthma home management, completion of periodic outpatient asthma monitoring visits, and development of a relationship with a primary care provider. The interventions focused on coaching the parents. Overall the results demonstrated that parental asthma coaching intervention did improve outpatient asthma monitoring visits which were infrequent and did not decrease emergency department visits in comparison to the control group.

Newcomb, P. (2006). Results of an asthma disease management program in an urban pediatric community clinic. *J Spec Pediatr Nurs, 11*(3), 178-188. doi: 10.1111/j.1744-6155.2006.00064.x

Impact Factor: Not Available

Quality of Evidence: Acceptable

n=79
Outcome-based evaluation
This study evaluated the Children's Asthma Management Program (CHAMP), which was developed and implemented by nurse practitioners to improve the consistency of asthma management, adherence to treatment plans, and essentially improve clinical outcomes for asthmatic children from low-income families. The program was designed to implement the National Institute of Health (NIH) guidelines. The intervention consisted of an initial 45 minute visit, then a 30 minute follow-up visit at one month, and then 30 minute quarterly follow-up visits. During these visits, the nurse practitioner developed treatment plans, monitored the patient's asthma status, provided education, prescribed medications, evaluated outcomes and made referrals if necessary. In between visits the RN case manager sustained telephone contact with the families; she also obtained interval history and collected information regarding symptom frequency through her phone calls. She also devoted a significant amount of time to helping the patients' families "negotiate the healthcare and social service systems to obtain mediations, equipment, and other basic necessities." The CHAMP intervention demonstrated an 85% decrease in asthma-related hospitalizations, 87% decrease in emergency room visits for asthma, and a 71% decrease in clinic visits for treatment of acute exacerbations. Furthermore, the parents of the children "reported feeling more capable of managing their child's asthma symptoms at home and perceived patients' overall physical health was improved over the course of the program." It was also noted that children who strongly adhered remain in the program for longer periods. Overall, CHAMP attained its goal of "improving service utilization outcomes of children with asthma by means of an evidence-based intervention."

National Center for Heart Lung and Blood Institute. (2007). National Asthma Education and Prevention Program Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma Full Report. United States Department of Health and Human Services. Retrieved April 6, 2012, from http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
Guideline
The importance of monitoring the history of the asthma patient by the provider is stressed in this document. Multiple care providers' communication is essential, especially when in a large healthcare center. Special services rendered for care are defined as inquiring about unscheduled visits to the providers, telephone calls for assistance, use of urgent and emergent care facilitates and the communication for the provider team are important. Continuity of care from one provider, or one set of providers is important, or including facilitation of this via request of summaries of all care received.

Love and coworkers (2000) demonstrated that continuity of different clinicians did improve patient adherence and quality of care. Yawn (2003) noted that parents are frustrated with clinician's communication, especially regarding changes in diagnoses classification and severity. Cabana and colleagues (2003, 2005) as well as Yawn (2004) found the need to document patient and clinician communications to improve the content of subsequent clinicians' communication. Patel (2004) found that multidisciplinary asthma disease- management showed improvement in several cases, but not all. However, it was found that emergency service and

hospitalizations were reduced when multidisciplinary care was utilized. Key ownership from the clinician was essential.

Evens et al., (1999b) reviewed a system wide restructured program including use of a standardized treatment protocol, direct admission policy with primary care physicians, optional specialist consultation, and use of case managers' to help families address barrier's to care. This program reduced emergency visits and length of stay in the participating hospitals.

Peretz, P. J., Matiz, L. A., Findley, S., Lizardo, M., Evans, D., & McCord, M. (2012). Community Health Workers as Drivers of a Successful Community-Based Disease Management Initiative. *American Journal of Public Health, 102*(8), 1443-1446. doi: 10.2105/ajph.2011.300585

Impact Factor: 3.93
Quality of Evidence: Limited

n=472
Informational Article/Field Action Report
Community healthcare workers implemented a new educational program placed in community organizations and the local hospitals for culturally appropriate education and support to help families with asthma. After 12 months of intense education, emergency department visits were decreased by 50%. The role of the community partners was noted as the key to the success of the program. Community health care workers were hired just for this program, no educational or licensure restrictions were made, all had to have two years past experience as a community health worker. The workers were trained at the hospital on evidence based care practice, community setting and availability of social services. They conducted hospital rounds and home environmental assessments as well. This unique role was credited as the success to this program.

Postma, J., Karr, C., & Kieckhefer, G. (2009). Community health workers and environmental interventions for children with asthma: a systematic review. *J Asthma, 46*(6), 564-576. doi: 10.1080/02770900902912638

Impact Factor: 1.52
Quality of Evidence: Acceptable

n=Not Specified
Systematic Review, RCTs=7
The study assessed community health worker delivered interventions for pediatric asthma. The studies did have a focus on minorities with low-income and urban residence. The studies analyzed did support the effectiveness of community health worker delivered interventions. There were demonstrated decreased asthma symptoms, lessened daytime activity limitations, and lessened emergency and urgent care use.

Rollins, G. (2004). Study demonstrates effectiveness of new model of pediatric asthma care. *Rep Med Guidel Outcomes Res, 15*(20), 1, 6-7.

Impact Factor: Not Available
Quality of Evidence: Limited

n=638
This article focused on two different approaches to improve asthma care in primary care settings. The first approach involved peer leader education and the second approach was planned care intervention. The participants in the peer leader program had 6.5 fewer symptom days per year and a 36% lower rate of oral steroid use when compared to the usual care participants. The planned care group had 13.3 fewer symptom days per year and a 39% lower rate of oral steroid usage than usual care. Planned care was noted to be more expensive however the outcomes were more significant. The planned care method even though effective was noted to possibly be "impractical for 'real life' settings." It was noted that specific elements of the planned method could be incorporated to improve asthma care.

Rowane, W. A., & Rowane, M. P. (1999). An osteopathic approach to asthma. *J Am Osteopath Assoc, 99*(5), 259-264.

Impact Factor: Not Available
Quality of Evidence: Limited

This paper provided information regarding management of asthma by the use of nonpharmacologic modes of therapy such as osteopathic manipulative treatment. For example, "there is a suggestion that respiratory rate decreases and tidal volume increases after osteopathic manipulative therapy. This rate-volume alteration should improve the mechanics of respiration and may favorably influence ventilation-perfusion relationships and pulmonary gas-exchange." When patients are in the emergency room, an osteopathic physician can alleviate some of the distress such as reducing muscle tension, decreasing anxiety, and improve respiratory function by way of administration of osteopathic manipulative therapy.

Schulte, A., Musolf, J., Meurer, J. R., Cohn, J. H., & Kelly, K. J. (2004). Pediatric asthma case management: a review of evidence and an experimental study design. *J Pediatr Nurs, 19*(4), 304-310. doi: 10.1016/j.pedn.2004.05.003

Impact Factor: Not Available
Quality of Evidence: Limited

n=Not Specified
Informational Article
The management of childhood asthma by social service professionals, lay health workers, and nurses is examined in this review. The review presents a randomized control trial that measured factors of success with case management. It is purposed that positive outcomes measured during this study will outweigh the expense of the utilization of the case managers.

Velsor-Friedrich, B., Pigott, T., & Srof, B. (2005). A practitioner-based asthma intervention program with African American inner-city school children. *J Pediatr Health Care, 19*(3), 163-171. doi: 10.1016/j.pedhc.2004.12.002

Impact Factor: Not Available
Quality of Evidence: Limited

n=52
Quasi-experimental pre- and posttest design
The study assessed the outcomes of a school-based asthma intervention program on the self-

care abilities, self-care practices, and health outcomes of African American children with asthma. The educational component of the program involved an Open Airways Asthma Education Program which was developed at Columbia University in conjunction with the American Lung Association. The program had six, 45 minutes sessions offered once per week in small groups where children learned new asthma management skills. The second component of the intervention was five monthly visits with a nurse practitioner at the school-based health clinical. Children in the intervention group demonstrated significant improvements in self-cares measures, however there were not significant findings in health outcomes which included peak expiratory flow rate, symptom frequency, rescue medication use, urgent doctor visits, or school absenteeism.

Vilar, M. E., Reddy, B. M., Silverman, B. A., Bassett, C. W., Rao, Y. A., Chiaramonte, L. T., & Schneider, A. T. (2000). Superior clinical outcomes of inner city asthma patients treated in an allergy clinic. *Ann Allergy Asthma Immunol, 84*(3), 299-303. doi: 10.1016/s1081-1206(10)62777-9

Impact Factor: Not Available
Quality of Evidence: Limited

n=44
Two Phased Study
The study assessed the impact of an allergy clinic on clinical outcomes of inner city asthma patients, who ranged in age from 11 months to 73 years, that were treated in an allergy clinic in Brooklyn, NY. The study was performed in two phases and occurred over three periods: 1 year prior (year 0), during first year (year 1), and during second year (year 2). The intervention used during phase I consisted of "clinic visits every 1 to 8 weeks, peak flow meter training and home monitoring, training in the proper use of metered dose inhalers and spacers, optimal anti-inflammatory and bronchodilator dosages, education on environmental control measures, and immunotherapy when indicated. "Phase II interventions consisted of administration of a non specific health-related quality of life questionnaire. The results demonstrated a significant reduction in hospitalization and emergency room visits especially during the first year of the intervention. However this reduction did not differ between good compliers and poor compliers. There was a decrease in disease severity in patients and good compliers experienced even less severity of disease. The phase II intervention produced quality of life scores that were lower in the asthma patients when compared to the general population; however those from the allergy clinic had better quality of life scores than the group from the primary care or emergency department. Overall the study demonstrated that inner city asthmatic patients treated in the allergy clinic had better clinical outcomes, such as reduction in the number of hospitalizations and emergency room visits, and significant improvement in disease severity, especially compliant patients, when compared to patients treated in a non-allergy clinic.

Webber, M. P., Carpiniello, K. E., Oruwariye, T., Lo, Y., Burton, W. B., & Appel, D. K. (2003). Burden of asthma in inner-city elementary schoolchildren: do school-based health centers make a difference? *Arch Pediatr Adolesc Med, 157*(2), 125-129.

Impact Factor: Not Available
Quality of Evidence: Limited

n=949
Longitudinal Study
This study assessed the outcomes associated with access to inner-city school-based health

centers. Six elementary schools were used to obtain data. Four of the schools had school-based health centers. The services provided at these health centers were by a pediatrician or a nurse practitioner with after hour services provided by two community health centers. The study did report that children with school-based health centers had a lower hospitalization rate as well as 3 more days of school in comparison to asthmatic children who did not have a school-based health center. The children who had access to the school-based health center however did not show an improvement in emergency department use.

IV. Research Question 3

Summary

Asthma is a leading cause for pediatric emergency visits and hospital admissions. Additionally there are substantial costs attributed to asthma management. This research question is designed to elicit the findings and recommendations from review of the literature related to asthma care and the impact of a multidisciplinary team on the care process. The literature summarized here suggests that the utilization of hospital resources (emergency and in-patient admissions), could be reduced via multidisciplinary asthma care management, in addition to adherence to asthma guidelines.

Many of the studies included here described programs focused on low-income, inner-city pediatric populations. The literature identified a number of issues that contribute to the challenge of appropriate asthma care. Among these are:

- Primary care physician lack of asthma guidelines knowledge.
- Lack of parents understanding of the severity of the disease.
- Poor adherence to medication management.
- Barriers to resource procurement.

In an effort to address the above noted issues, a number of programs have been implemented worldwide with a focus on physician education and implementation of a multidisciplinary team program for asthma care management.

With respect to primary care physicians (PCPs) and the asthma guidelines, one study evaluated the impact of a physician educational seminar in enhancing the knowledge and skills of the physicians in treating childhood asthma. Two major components of the program were: 1) optimal clinical practice based upon the National Asthma Education and Prevention Program (NAEPP) guidelines and 2) patient teaching and communication. Analysis suggested that the physician educational seminar may have helped providers to better identify and assist patients who needed inhaled anti-inflammatory medication therapy, and to give the parents an asthma action plan (Brown et al., 2004). Another study on the use of the guidelines by primary care providers demonstrated the effectiveness of a disease management program (Easy Breathing™) based upon the NAEPP guidelines. In this study, asthma was managed entirely by PCPs (Cloutier et al., 2005). Both of these studies demonstrated reduced rates in use of emergency services and hospital admissions.

There was a number of multidisciplinary care team models found in the literature. Some were lead by nurse practitioners, others by masters prepared social workers. Team members also included pediatric allergists and Certified Pediatric Nurse Practitioners (CPNPs). Other programs demonstrated success with lay health workers who served as a liaison between families and the health care system (Bryan-Stephens et al., 2009 and Stout et al., 1998).

Despite subtle differences, the multidisciplinary team programs shared common elements that contributed to the success of the programs:

- Intensive asthma education
- Development of an individualized asthma action plan
- Home visitation with environmental assessment of triggers

- Medication management
- Routine follow-up

The importance of implementing strategies based upon the application of NAEPP clinical practice guidelines was also a key component for the multidisciplinary care models (Fox et al., 2007).

Intensive asthma education was a key component from which the care processes seemed to fall into place. A major barrier to compliance in the care of the asthmatic child was parental lack of understanding about the severity of a child's illness. Due to limited resources, many children did not adhere to medication management if they were symptom free. The parents did not understand the necessity for managing triggers in the environment, and they were not reliable with follow-up visits. Evidence suggests that when parents had greater knowledge of asthma, they were more likely to comply with preventative treatment (Boyd et al., 2010).

The community home visits were beneficial in that the community health workers (CHWs) were able to identify and tailor strategies to their patient's needs (Fox et al., 2007). They were able to assist the families of asthmatic children in mitigating environmental risk factors, in addition to gaining access to available resources. The home visits were instrumental in allowing the CHWs to truly individualize the asthma action plan.

Adherence to maintenance medication and correct use of the inhaler device are key factors in obtaining asthma control. Medication compliance is a serious issue for asthmatic children. Medication non-compliance can be a result of lack of understanding of the disease, lack of resources to obtain proper medication, or lack of understanding about appropriate medication administration. Medication management was a key component of the multidisciplinary asthma management programs. The literature suggests that improved medication compliance contributed to the decrease in emergency visits and hospitalizations.

Team availability was a contributing factor to the success of the multidisciplinary team model. In one randomized trial, patient caregivers were encouraged to call 24 hours a day, 7 days a week for any symptoms that did not respond to treatments of inhaled bronchodilators (Harish et al., 2001).

In conclusion, the literature supports the implementation of multidisciplinary team care processes for the management of asthma in children. The team process fosters adherence to clinical practice guidelines, intensive asthma education, and medication compliance, all of which demonstrate the potential for decreasing emergency department visits and in-patient hospital admissions.

Bibliography

Allcock, D. (2009). Using a community respiratory service to reduce children's hospital admissions. *Changing Practice* , *105*(4), 22-23.

Impact Factor: Not Available
Quality of Evidence: Limited

n=Not Specified
Informational Article
This article described a program implemented in the United Kingdom that evaluated the utilization of an advanced pediatric nurse practitioner as a community matron. The community

matron delivered tailored education service to children and families in their homes/environments to reduce respiratory hospital admissions.

In a one year period:

- Potentially 53 emergency visits and 82 emergency admissions were averted
- 81% of parents stated that since seeing the community matron their understanding of their child's condition had improved significantly
- Nearly two-thirds noted since being case managed by the service they could manage their child's condition more effectively
- Over three-quarters stated they had to visit their general practitioner less often and 69% felt the number of admissions had been reduced
- An improvement in parental knowledge and attitude surrounding dealing with exacerbations, and reductions in general practice and hospital visits was shown

The author concluded that this community-based nursing practice demonstrated a need to broaden the scope of this service to pediatric patients.

Asthma DM effort slashes utilization, produces substantial ROI. (2001). *Disease Management Advisor, 7*(10), 145-149.

Impact Factor: Not Available
Quality of Evidence: Limited

n=Not Specified
Informational Article
Article describing Connecticut based (ConnectiCare) disease management program (BREATHE) implemented to improve quality of life and reduce health care costs of asthma patients. The program utilized risk stratification and telephonic case management strategies, in addition to employing a predictive model in order to identify asthmatics likely to become future high utilizers of services. In five years the program achieved a 40% reduction in emergency room visits among asthma members, a 21% decrease in hospitalizations, and a 119% return on investment. The greatest challenge was demonstrated to be care of the younger asthma patients. It was demonstrated that the greatest utilizers of care and services was the 0 – 4 age group. The difficulties in treating this group were attributed to difficulty in diagnosis, determination of proper medications, healthcare providers lack of experience in dealing with this age group, and variability in parental compliance.

Asthma intervention put to the test with inner-city kids. (2001). *Disease Management Advisor, 7*(11), 161-165

Impact Factor: Not Available
Quality of Evidence: Limited

n=Not Specified
Informational Article
Article describing a program developed by the National Institute of Allergy and Infectious Diseases (NAID) and tested by the National Cooperative Inner-City Asthma Study (NCICAS). The successful disease management intervention constituted the use of a masters prepared social worker, who served as an asthma counselor working directly with families of inner-city children to maintain optimal management of asthma. Medication compliance was the focus of

the intervention set up to be complementary to the medication based asthma management plan provided by a child's primary care physician. The intervention consisted of a risk assessment, development of a plan of care, plan implementation, and assistance with procuring resources. Education of the family members proved to be a challenge in addition to being labor intensive. In some cases incentives such as provision of child care or transportation were employed in order to facilitate adherence to the intervention. The program yielded positive results demonstrating that children with severe asthma gained six weeks of symptom-free days per year and that the effects of the intervention lasted through the follow-up year in which the asthma counselor was no longer in place. The program was taken up by the Centers for Disease Control (CDC) in subsequently awarding grants to 23 community-based sites serving inner-city populations nationally. Limitations of the study were recognized to be: finite resources, target age of 5 – 11 year olds, and family reluctance to participate without incentives. Despite the limitations it is believed that the program has the potential to yield positive results.

Boyd, M., Lasserson, T. J., McKean, M. C., Gibson, P. G., Ducharme, F. M., & Haby, M. (2010). Interventions for educating children who are at risk of asthma-related emergency department attendance. *The Cochrane Collaboration*, 1-116.

Impact Factor: 5.72
Quality of Evidence: Acceptable

n=7843
Cochrane Review
This review comparing usual care for asthma to more intensive educational programs included a total of 38 studies and 7843 children. The interventions reviewed involved the following practitioners: nurse, pharmacist, educator or health or medical practitioner associated with the hospital or referred to by the hospital. Educational interventions delivered for patients presenting to the emergency department for acute exacerbations was shown to significantly reduce risk of subsequent emergency department visits (RR 0.73, 95% CI 0.65 to 0.81, N = 3008) and hospital admissions (RR 0.79, 95% CI 0.69 to 0.92, N = 4019) with the risk of subsequent emergency department visits following educational intervention reduced by just over a quarter. There were also fewer unscheduled doctor visits (RR 0.68, 95% CI 0.57 to 0.81, N = 1009). There remains uncertainty as to the long-term effect of education on other markers of asthma morbidity such as quality of life, symptoms and lung function, as very few data were available for other outcomes (FEV1, PEF, rescue medication use quality of life or symptoms) and there was no statistically significant difference between education and control.

This review also found the nature and delivery of educational intervention varied between the studies and authors were not able to identify the exact characteristics of educational interventions (such as type, duration, and intensity) which were most effective in reducing acute care utilization. However, there is evidence to suggest that many hospital admissions could be prevented if children and their parents were given and used an individualized asthma management plan, had greater general knowledge of asthma, complied with their preventive treatment, commenced appropriate medication early during an asthma attack and sought local medical assistance early if their condition was not improving (Ordonez 1998).

Brouwer, A. F., & Brand, P. L. (2008). Asthma education and monitoring: what has been shown to work. [Review]. *Paediatric Respiratory Review, 9*(3), 193-199; quiz 199-200. doi: 10.1016/j.prrv.2008.03.001

Impact Factor: 2.2

Quality of Evidence: Limited

n=Not Specified
CME Article
Article that looked at Cochrane systematic reviews and meta-analyses on education and monitoring of asthmatic children. The authors felt that although there is little doubt that education is useful, the effective components of an education program need to be substantiated by randomized controlled trials in addition to observational studies. It was concluded that the education of children with asthma and their parents is effective in improving clinically relevant outcomes. Education should include basic information about the disease, its influencing factors, as well as inhalation instructions. There is a lack of evidence to justify home monitoring of lung function; symptom monitoring suffices. The article noted that the best chance for improved outcomes is demonstrated by a partnership between the health care team, the patient, and parents. A crucial component is the level of agreement between the physician and patient with respect to mechanisms of asthma, identification of triggers, and treatment. Adherence to maintenance medication and correct use of the inhaler device are key factors in obtaining asthma control. The article suggests that once a partnership is established with initial treatment agreed upon, follow-up can be turned over to nursing care providers. Future studies were recommended in order to determine which components of asthma education are vital in demonstrating positive patient outcomes.

Brown, R., Bratton, S. L., Cabana, M. D., Kaciroti, N., & Clark, N. M. (2004). Physician Asthma Education Program Improves Outcomes for Children of Low-Income Families*. *Chest Journal* , *126*(2), 369-374.

Impact Factor: Not Available
Quality of Evidence: Limited

n=74 physicians, 636 patients
Informational Article
Study conducted to determine whether an interactive physician seminar (provided to primary care pediatricians); shown to decrease emergency department visits for children with asthma, was also effective for asthmatic children from low-income families. The physician education program was an interactive seminar based on self-regulation theory and emphasized asthma treatment in addition to physician communication and patient education skills.

The study demonstrated that the low-income treatment group children were significantly less likely to be admitted to an emergency department (annual rate, 0.208 vs. 1.441, respectively) or to a hospital (annual rate, 0 vs. 0.029, respectively) for asthma care compared to children in the control group. Positive but not statistically significant results were that the low-income children demonstrated better use of controller medications, were more likely to have received a written asthma action plan, and tended to miss fewer days of school. Analysis suggests that the physician educational seminar may have helped providers to better identify and assist patients in this high-risk (low-income) group who needed inhaled anti-inflammatory medication therapy, and to give the parents an asthma action plan.

Bryant-Stephens, T., Kurian, C., Guo, R., & Zhao, H. (2009). Impact of a household environmental intervention delivered by lay health workers on asthma symptom control in urban, disadvantaged children with asthma. *American Journal of Public Health, 99 Suppl 3*, S657-665. doi: 10.2105/ajph.2009.165423

Impact Factor: 3.93
Quality of Evidence: Limited

n=264
Informational Article
Study conducted to determine if a home-based educational and environmental intervention delivered by lay health educators would improve asthma symptom control in inner-city children with asthma. The hypothesis of the study was that providing families with education and environmental strategies would result in sustainable practices in the home that would reduce asthma morbidity in children. The program included children aged 2 to 16 years who had asthma diagnosed by a physician and who were taking a controller medication for treatment. The home interventions were conducted by lay educators who received intensive training about asthma, asthma symptoms and triggers, environmental trigger removal methods, asthma medications, learning styles, and proper use of asthma devices. The environmental intervention targeted appropriate avoidance measures for dust, pests, pets, and smoke in addition to assisting families in the implementation of these measures in the child's bedroom.

Results demonstrated that the mean number of emergency visits decreased by 30% and inpatient visits decreased by 53%. It was concluded that lay health educators effectively reduced asthma triggers and increased caregiver asthma knowledge, which resulted in reduced emergency department visits, hospitalizations, and asthma symptoms.

Centers for Disease, Control., & Prevention. (2005). Reducing childhood asthma through community-based service delivery--New York City, 2001-2004. *MMWR Morbidity Mortality Weekly Report, 54*(1), 11-14.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=314
Informational Article
Report of the Harlem Children's Zone Asthma Initiative (HCZAI) that was established in 2001 to reduce asthma-related morbidity through improved surveillance, health-care use, and health-care service delivery for children aged <12 years. The HCZAI, pediatric asthma team consists of community workers, a social worker, a nurse, and a physician. The program offers medical, educational, environmental, social, and legal services to families of enrolled children. Monitoring of asthma symptoms and management strategies is conducted via home visits by the community workers. Preliminary data indicated decreased reports of school absences among program enrollees. Additionally, a decrease in emergency department and unscheduled physician office visits for treatment of asthma decreased from 35% to 8% after 18 months of the program, suggesting improved asthma management and appropriate use of healthcare services. Some limitations identified by the team included: unwillingness of families to enroll their children in HCZAI because they did not believe the asthma diagnosis was correct, problems with scheduling home visits, and failure to capture the full extent of client needs due to the burden of monitoring. Despite the limitations it was concluded that the HCZAI program was an effective community-based public health program in reducing asthma morbidity.

Cloutier, M., Hall, C., Wakefield, D., & Bailit, H. (2005). Use of Asthma Guidelines by Primary Care Providers to Reduce Hospitalizations and Emergency Department Visits in Poor, Minority, Urban Children. *The Journal of Pediatrics, 146*, 591-597.

Impact Factor: 4.02
Quality of Evidence: Acceptable

n= 3748
Informational Article
Study conducted to determine whether a systematic, standardized, asthma disease management program (Easy Breathing™) would increase adherence by primary care physicians (PCPs) to the 1997 National Asthma Education and Prevention Program (NAEPP) guidelines. The study included children enrolled in the program from June 1, 1998 – August 31, 2002 and focused on anti-inflammatory therapy and whether greater adherence was associated with a decrease in hospitalizations and emergency department (ED) visits in low-income, minority children who resided in Hartford, Connecticut.

The Easy Breathing™ program focused on four elements of care: diagnosing asthma, determining asthma severity, prescribing therapy appropriate for the asthma severity, and developing a written Asthma Treatment Plan that is given to the family.

48% of 3748 children with a confirmed diagnosis of asthma had persistent disease. Results demonstrated a 25% increase in the use of inhaled corticosteroids. Provider adherence to guidelines for anti-inflammatory therapy increased from 38% - 96%. Children enrolled in the program demonstrated an overall 35% decrease in hospitalization and a 27% decrease in ED visits.

The study demonstrated the effectiveness of a disease management program based upon the NAEPP guidelines in reducing asthma morbidity in a large group of low-income, urban, minority children whose asthma was managed entirely by PCPs.

Coffman, J. M., Cabana, M. D., Halpin, H. A., & Yelin, E. H. (2008). Effects of Asthma Education on Children's Use of Acute Care Services: A Meta-analysis. *Pediatrics* , *121*(3), 575-586.

Impact Factor: 5.44
Quality of Evidence: Acceptable

n=Not Specified
Meta-analysis
Analysis conducted to estimate the effects of pediatric asthma education on visits to the emergency department, hospitalizations, and urgent physician visits. Children aged 2 to 17 years with a clinical diagnosis of asthma were included. Of 208 abstracts reviewed, 37 articles met the inclusion criteria. Twenty-seven compared educational interventions to usual care, and 10 compared different interventions. Among studies that compared asthma education to usual care, education was associated with statistically significant decreases in mean hospitalizations and mean emergency department visits. Education did not affect the odds of hospitalization or the mean number of urgent physician visits. This may have been attributed to the fact that with the education received, caregivers and children may have been more aware and thus prompted to seek office-based care when experiencing symptoms. Findings from studies that compared different types of asthma education interventions suggest that providing more sessions and more opportunities for interactive learning may produce better outcomes.

It was concluded that education contributes to the prevention of visits to the emergency department if asthma is appropriately managed by the child's caregiver and office-based asthma care providers. The findings suggest that additional research is needed to assist clinicians, medical groups, and health plans in determining the specifics of asthma education.

Critical Path Network: education decreases ED visits for young asthma patients. (2005). *Hospital Case Management, 13*(1), 7-8

Impact Factor: Not Available
Quality of Evidence: Limited

n= Not Specified
Informational Article
Article describing a pediatric asthma program implemented at a medical center in Flint, Michigan. The program includes home visits and intensive asthma education provided by a pediatric asthma case management team. The team consists of an RN pediatric disease manager (who is also a certified asthma educator), another RN, and a social worker. Referrals are made by the primary care physicians and can also come from any patient under 18 seen in the emergency department. In working with young patients and families, the team focuses on understanding and controlling asthma, the appropriate use of medications, compliance with treatment plans, and control of environmental triggers. Response to home visits has been positive. The home visits also allow the team to assess the patient/family needs and to assist them in procuring essential resources that they may be eligible for, in addition to those needed to assist them in being compliant with meeting the asthma treatment plans.

Eakin, M. N., Rand, C. S., Bilderback, A., Bollinger, M. E., Butz, A., Kandasamy, V., & Riekert, K. A. (2012). Asthma in Head Start children: effects of the Breathmobile program and family communication on asthma outcomes. *Journal of Allergy and Clinical Immunology, 129*(3), 664-670. doi: 10.1016/j.jaci.2011.10.013

Impact Factor: 11.0
Quality of Evidence: Limited

n=322
Randomized Control Trial
Trial conducted to evaluate the effects of providing Breathmobile services only, a Facilitated Asthma Communication Intervention (FACI) only, or both Breathmobile plus FACI on asthma outcomes relative to standard care. The Breathmobile is a mobile asthma clinic that delivers services directly to inner-city children at their schools or Head Start sites. Care is provided by a specially trained nurse practitioner, allergist, nurse, and driver/patient assistant. Families randomized to the FACI received a single home session with an asthma educator (AE). The study included children aged 2 to 6 years from all 66 Head Start sites in Baltimore. The interventions in the study were intended to remove common barriers to asthma care such as transportation, access to care, and health insurance status. In addition, they were designed to empower families to communicate with their physicians. Other than slight improvement in symptom free days at 6 months in the Breathmobile plus FACI these intervention strategies did not result in any significant improvements in asthma management or asthma morbidity among low-income preschool children. Further studies are needed.

Fox, P., Porter, P. G., Lob, S. H., Boer, J. H., Rocha, D. A., & Adelson, J. W. (2007). Improving asthma-related health outcomes among low-income, multiethnic, school-aged children: results of a demonstration project that combined continuous quality improvement and community health worker strategies. *Pediatrics, 120*(4), e902-911. doi: 10.1542/peds.2006-1805

Impact Factor: 5.44
Quality of Evidence: Acceptable

n=560
Informational Article
Article describing the California Asthma Among the School Aged (CAASA) project. This was a demonstration project conducted to improve asthma-related health outcomes in an ethnically and geographically disparate population of economically disadvantaged school-aged children (5-18 years of age). The basis of the project interventions involved continuous quality improvement (CQI) implemented by a multidisciplinary clinic-based team which included community health workers (CHWs). The population was assessed for care-process changes in addition to asthma related outcomes, satisfaction with care, and confidence in self-management. The outcomes evaluated included asthma symptoms, use of rescue medications, acute care and emergency department visits, hospitalizations, and missed school days. Results demonstrated improvements in the documentation of asthma severity, review of action plans, health services use, and asthma symptoms. There was a decrease in patients reporting acute visits, emergency department visits, hospitalizations, frequent symptoms, and missed school days compared with baseline. The following strategies are seen as integral components of the process: (1) the use of technical assistance in support of CQI; (2) incorporating CHWs with direct roles in the clinical practice as part of the CQI team; (3) the application of clinical practices based on NAEPP (National Asthma Education and Prevention Program) guidelines; and (4) the ability of the clinic teams to identify and tailor quality improvement strategies to their patients. The authors concluded that the demonstration project produced major improvements in asthma-related care processes and clinical outcomes.

Greineder, D. K., Loane, K. C., & Parks, P. (1995). Reduction in resource utilization by an asthma outreach program. *Archives of Pediatrics & Adolescent Medicine, 149*(4), 415-420.

Impact Factor: 4.14
Quality of Evidence: Limited

n=53
Uncontrolled Trial
Trial conducted to determine the effect of an asthma outreach program on the utilization of emergency services and hospitalization. The outreach program staff included an allergy nurse, an allergy nurse practitioner, and an allergist. The outreach team also worked with the primary care pysician who was involved in development of the treatment plan. The plan involved an initial home visit by the allergy nurse that was followed up by subsequent phone calls. Focus of the intervention included individual education (including a written action plan) on triggers, avoidance of environmental factors, signs and symptoms and approrpaite medication use. Results demonstrated a 79% decrease in emergency admissions and an 86% decrease in hospital admissions over a two year period.

Greineder, D. K., Loane, K. C., & Parks, P. (1999). A randomized controlled trial of a pediatric asthma outreach program. *Journal of Allergy and Clinical Immunology, 103*(3 Pt 1), 436-440.

Impact Factor: 11
Quality of Evidence: Limited

n=57
Randomized Control Trial (RCT)
Trial conducted to study the effect of an asthma outreach program (AOP), a team-based, case-management intervention, on emergency department (ED) and hospital use. The AOP staff included an allergy nurse, an allergy nurse practitioner, and an allergist. Different than the study noted above, in this RCT the control group received a single intensive asthma education intervention. The AOP group received the same initial education with the addition of follow-up by an asthma case management nurse throughout the intervention period. Outcomes measured included ED visits, hospitalizations, and total outside-of health-plan expenditures (ED and hospital expenses, and miscellaneous costs, such as ambulance, durable medical equipment, tertiary referrals, and home care). Results demonstrated that patients in the control group experienced a 39% reduction in ED visits, 43% less hospitalizations and 28% less outside-of-health-plan costs. The AOP group demonstrated significant results demonstrated by a 73% decrease in ED visits, 84% decrease in hospitalizations, and an 82% decrease in outside-of-health-plan costs.

Harish, Z., Bregante, A. C., Morgan, C., Fann, C. S., Callaghan, C. M., Witt, M. A., . . . Caspe, W. B. (2001). A comprehensive inner-city asthma program reduces hospital and emergency room utilization. *Annals of Allergy Asthma and Immunology, 86*(2), 185-189. doi: 10.1016/s1081-1206(10)62689-0

Impact Factor: 2.83
Quality of Evidence: Acceptable

n=300
Prospective Randomized Trial
A 12-month trial conducted to evaluate the impact of a comprehensive asthma program on emergency department (ED) visits and hospital admission rates in an inner-city pediatric population. One hundred twenty-nine patients were included in the final analysis. The Pediatric Asthma Center team included a pediatric allergist, three Certified Pediatric Nurse Practitioners (CPNPs), and a social worker. Introduction to the program included initial intake to the center which consisted of three 1 hour visits conducted two weeks apart. These visits were dedicated to history taking, medication management, and allergy skin testing. Part of the program included caregiver availability via phone 24-7. In addition to services provided by the asthma program, most of the patients were also visited by the Visiting Nurse Service. Analysis of asthma severity of the 129 patients demonstrated that the patients in the treatment group had a higher rate of asthma severity. The trial results demonstrated that in the first year the treatment group visited the ED a total of 73 times compared to 269 for the control group. There were 22 overnight admissions in the treatment group vs. 29 in the control group. Of the patients in the treatment group, 16 were admitted to the hospital during the first year, but only 6 were admitted during the second year of the trial. There were a number of factors that attributed to the success of the program. The first included 24 hour availability of a care provider which allowed initiation of corticosteroids early in the asthma episode. Frequent follow-up visits allowed for determination of medication use and compliance. The identification of environmental allergies supported mitigation of triggers. The authors concluded that the program demonstrated strong potential for decreasing emergency service utilization and reduction in asthma related hospitalizations.

Kelly, C. S., Morrow, A. L., Shults, J., Nakas, N., Strope, G. L., & Adelman, R. D. (2000). Outcomes evaluation of a comprehensive intervention program for asthmatic children enrolled in medicaid. *Pediatrics, 105*(5), 1029-1035.

Impact Factor: 5.44
Quality of Evidence: Limited

n=80
Controlled Clinical Trial
Trial conducted to evaluate health care and financial outcomes for Medicaid-insured asthmatic children after a comprehensive asthma intervention program. Children in the intervention group received medical treatment (continued by their primary care physician) and asthma education in a tertiary care pediatric allergy clinic. The program also included monthly contact with an asthma outreach nurse who in addition to evaluating asthma status promoted preventative services. The program followed the guidelines of the National Heart, Lung and Blood Institute (NHLBI). During the study year, ED visits decreased to a mean of 1.7 per patient in the intervention group and 2.4 in controls, while hospitalizations decreased to a mean of .2 per patient in the intervention group and .5 in the controls. Average asthma health care charges decreased by $721/child/year in the intervention group and by $178/patient/year in the control group. The authors concluded that significant improvement in health outcomes, in addition to a reduction in health care costs can be realized through utilization of a comprehensive asthma intervention program for Medicaid-insured asthmatic children.

Margellos-Anast, H., Gutierrez, M. A., & Whitman, S. (2012). Improving asthma management among African-American children via a community health worker model: findings from a Chicago-based pilot intervention. *Journal of Asthma, 49*(4), 380-389. doi: 10.3109/02770903.2012.660295

Impact Factor: 1.52
Quality of Evidence: Limited

n=70
Interventional Study
Study conducted in an inner-city Chicago hospital to evaluate the effectiveness of a community health worker (CHW) model in reducing asthma morbidity and improving quality of life for African-American children living in disadvantaged neighborhoods. Individualized asthma education was provided by trained CHWs during 3 – 4 home visits over a period of six months. Findings suggested improved asthma control as demostrated by a 35% reduction in symptom frequency and a 75% decreased use of urgent health care resources. Additional outcomes realized were improved asthma knowledge, decreased exposure to environmental asthma triggers, and improved medcial management. Parental qulaity of life also demonstrated improvement. The authors concluded that the CHW model for asthma education resulted in improved asthma management.

National Institutes of Health, National Heart, Lung, and Blood Institute. National Asthma Education and Prevention Program. Expert panel report 3: guidelines for the diagnosis and management of asthma, National Institutes of Health, Bethesda (2007) NIH publication no. 07-4051.

Impact Factor: Not Available
Quality of Evidence: Acceptable

n=Not Specified
The guidelines include the following recommendations with respect to involvement of multidisciplinary care providers:

Case Management for High-Risk Patients
The Expert Panel recommends that case or care management by trained health professionals be considered for patients who have poorly controlled asthma and have recurrent visits to the ED or hospital (Evidence B).

Cost-Effectiveness
The Expert Panel recommends that asthma self-management education that is provided by trained health professionals be considered for policies and reimbursements as an integral part of effective asthma care; the education improves patient outcomes (Evidence A) and can be cost-effective (Evidence B).

Establish and Maintain a Partnership
The Expert Panel recommends that when nurses, pharmacists, respiratory therapists, and other health care professionals are available to provide and support patient self-management education, a team approach through multiple points of care should be used (NHLBI 1995b,c).

Newcomb, P. (2006). Results of an asthma disease management program in an urban pediatric community clinic. *Journal for Specialists in Pediatric Nursing, 11*(3), 178-188. doi: 10.1111/j.1744-6155.2006.00064.x

Impact Factor: 0.83
Quality of Evidence: Limited

n=120
Informational Article
Article describing an outcome based evaluation of The Children's Asthma Management Program (CHAMP), designed and implemented by nurse practitioners to address the problem of inconsistent asthma management. The project was conducted in a community clinic system, based upon the concepts of evidence-based practice (the National Institutes of Health guidelines), in addition to the concept of patient–practitioner partnership. The study evaluated a nurse-practitioner-designed and managed, primary care, pediatric asthma clinic program. Specific outcomes evaluated included frequency of asthma related hospitalizations, emergency room visits, acute clinic visits, symptom frequencies, and adherence to medication regimens. Two key strategies for care focus were medication management and patient/family education. Results based upon the outcomes of the 79 children that completed the program demonstrated an 85% decrease in hospitalizations, an 87% decrease in emergency room visits, and a 71% decrease in acute office visits for asthma exacerbations. It was concluded that CHAMP achieved the objective of improving service utilization outcomes of children with asthma.

Stout, J. W., White, L. C., Rogers, L. T., McRorie, T., Morray, B., Miller-Ratcliffe, M., & Redding, G. J. (1998). The Asthma Outreach Project: a promising approach to comprehensive asthma management. *Journal of Asthma, 35*(1), 119-127.

Impact Factor: 1.52
Quality of Evidence: Limited

n=23
Pilot Study
Pilot conducted to evaluate an asthma care program directed to inner-city children with moderate to severe asthma. With this plan, the position of an asthma outreach worker (AOW) was implemented to serve as a liaison between families and the health care system. The role of this community based lay worker was to assess the patient's environment and to support the families in accessing available resources to meet health care needs. While the AOW worked with the family in the home environment, this individual also collaborated with the multidisciplinary clinic team comprised of a pediatrician, pharmacist, and public health nurse. The program was deemed successful in that it resulted in a reduction in hospitalizations, emergency department visits, and unscheduled clinic visits. Additionally an increase in follow-up clinic visits was noted.

Weng, H. C., Yuan, B. C., Su, Y. T., Perng, D. S., Chen, W. H., Lin, L. J., . . . Chou, C. H. (2007). Effectiveness of a nurse-led management programme for paediatric asthma in Taiwan. *Journal of Paediatrics and Child Health, 43*(3), 134-138. doi: 10.1111/j.1440-1754.2007.01032.x

Impact Factor: 1.28
Quality of Evidence: Acceptable

n=398
Retrospective Matched Cohort Study
Study conducted to evaluate the impact of a government sponsored disease management program for pediatric patients in Taiwan. This program was implemented in response to increasing costs and prevalence rates in addition to comparatively higher mortality of asthma. The objectives of the Healthcare Quality Improvement Program (HQIP) were to improve self-management; improve outcomes and quality of care; reduce costs related to asthma; increase patient and physician satisfaction with continuity of care; and promote adherence to guidelines. While the primary care physician retained accountability for the initial diagnosis and ensuring overall continuity of care, the asthma nurse took on the role of case manager. The study suggested that the asthma nurse played a significant role in educating and supporting the patient in self-management strategies. Results after one year of the program demonstrated that the intervention group of already diagnosed asthma cases had 77.97% fewer emergency department visits and 80.77% fewer inpatient visits. For the newly asthmatics, the intervention group had 35.11% fewer emergency department visits than the control group. It was concluded that the nurse-led management program proved useful in managing pediatric asthma in Taiwan.

Woods, E. R., Bhaumik, U., Sommer, S. J., Ziniel, S. I., Kessler, A. J., Chan, E., . . . Nethersole, S. (2012). Community asthma initiative: evaluation of a quality improvement program for comprehensive asthma care. *Pediatrics, 129*(3), 465-472. doi: 10.1542/peds.2010-3472

Impact Factor: 5.44
Quality of Evidence: Acceptable

n=283
Informational Article
Study conducted to evaluate the cost-effectiveness of a Community Asthma Initiative (CAI). The initiative included a quality improvement (QI) program developed to reduce emergency department (ED) visits, hospital admissions, physical activity limitations, and missed school days for patients with asthma. Low income asthma patients ages 2 – 18 were included in the

program. The model included: 1) nursing case management and coordination of care with primary care services, 2) home visits, and 3) referral to Integrated Pest Management services. The home visits conducted by either a nurse or a community health worker, included asthma education, environmental assessment, and remediation materials tailored to the needs of the family. Twelve month data demonstrated a 68% decrease in ED visits, an 84.8% decrease in hospital admissions, and a 41% decrease in missed school days. There was also a significant reduction in hospital costs. It was concluded that the cost savings of the program has generated sufficient data to guide advocacy efforts to finance comprehensive asthma care for children.

V. Appendix

Levels of Evidence

National Heart, Lung and Blood Institute (NHLBI)
RANKING THE EVIDENCE
The Expert Panel agreed to specify the level of evidence used to justify the recommendations being made. Panel members only included ranking of evidence for recommendations they made based on the scientific literature in the current evidence review. They did not assign evidence rankings to recommendations pulled through from the EPR—2 1997 on topics that are still important to the diagnosis and management of asthma but for which there was little new published literature. These "pull through" recommendations are designated by EPR—2 1997 in parentheses following the first mention of the recommendation. For recommendations that have been either revised or further substantiated on the basis of the evidence review conducted for the EPR—3: Full Report 2007, the level of evidence is indicated in the text in parentheses following first mention of the recommendation. The system used to describe the level of evidence is as follows (Jadad et al. 2000):

- **Evidence Category A: Randomized controlled trials (RCTs), rich body of data.** Evidence is from end points of well-designed RCTs that provide a consistent pattern of findings in the population for which the recommendation is made. Category A requires substantial numbers of studies involving substantial numbers of participants.

- **Evidence Category B: RCTs, limited body of data.** Evidence is from end points of intervention studies that include only a limited number of patients, post hoc or subgroup analysis of RCTs, or meta-analysis of RCTs. In general, category B pertains when few randomized trials exist; they are small in size, they were undertaken in a population that differs from the target population of the recommendation, or the results are somewhat inconsistent.

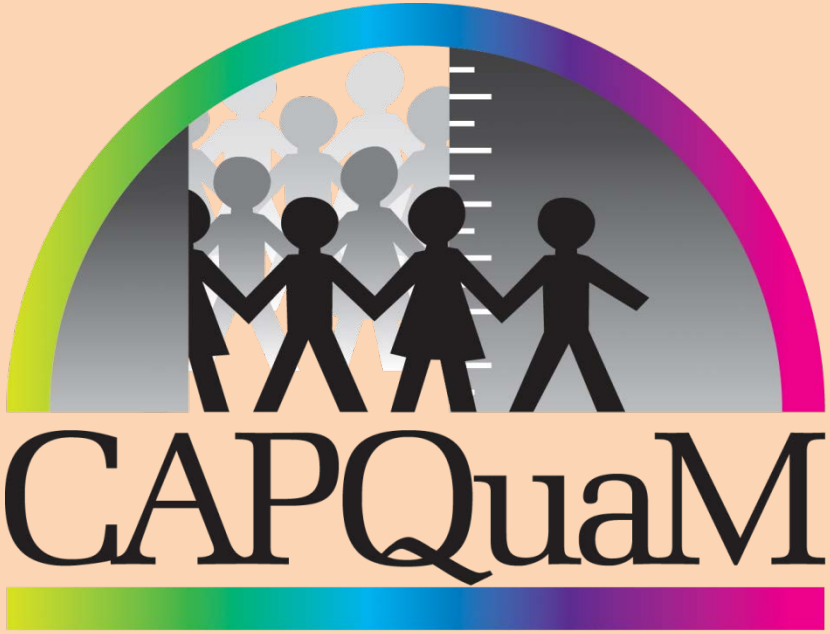
- **Evidence Category C: Nonrandomized trials and observational studies.** Evidence is from outcomes of uncontrolled or nonrandomized trials or from observational studies.

- **Evidence Category D: Panel consensus judgment.** This category is used only in cases where the provision of some guidance was deemed valuable, but the clinical literature addressing the subject was insufficient to justify placement in one of the other categories. The Panel consensus is based on clinical experience or knowledge that does not meet the criteria for categories A through C.

In addition to specifying the level of evidence supporting a recommendation, the Expert Panel agreed to indicate the strength of the recommendation. When a certain clinical practice "is recommended," this indicates a strong recommendation by the panel. When a certain clinical practice "should, or may, be considered," this indicates that the recommendation is less strong. This distinction is an effort to address nuances of using evidence ranking systems. For example, a recommendation for which clinical RCT data are not available (e.g., conducting a medical history for symptoms suggestive of asthma) may still be strongly supported by the Panel. Furthermore, the range of evidence that qualifies a definition of "B" or "C" is wide, and the Expert Panel considered this range and the potential implications of a recommendation as they decided how strongly the recommendation should be presented.

Appendix C

Powerpoint Presentation Orienting EP to the Process



COLLABORATION FOR ADVANCING
PEDIATRIC QUALITY MEASURES

CAPQuaM Expert Panel Orientation Presentation

Dr. Larry Kleinman, CAPQuaM PI

Children Are Not Young Adults

- 4 D's Model (Forrest & Dougherty)
  - Changing **D**evelopmental Status of Children
  - **D**ifferences in epidemiological patterns of disease
  - Differing **D**emography of children compared to adults
  - **D**ependent upon their parents / caregivers
- More D's
  - Lack of a **D**ata Infrastructure equivalent to Medicare
  - Lack of strong financial **D**rivers for research

Medicaid and the SCHIP Program

- Federal State partnership
- Major public insurance program for children
- Supplemented in late 1990's by State Child Health Insurance Program (CHIP or SCHIP)
  - For working poor who did not qualify for Medicaid
  - Benefits and eligibility vary by state
  - Could be Medicaid expansion or separate program

Children's Health Insurance Program Reauthorization Act (CHIPRA), 2009

- CHIP = Children's Health Insurance Program
  - administered at the state level
  - insures low-income children whose parents do not qualify for Medicaid
  - reauthorizes CHIP through 2013
- Creates the Pediatric Quality Measures Program

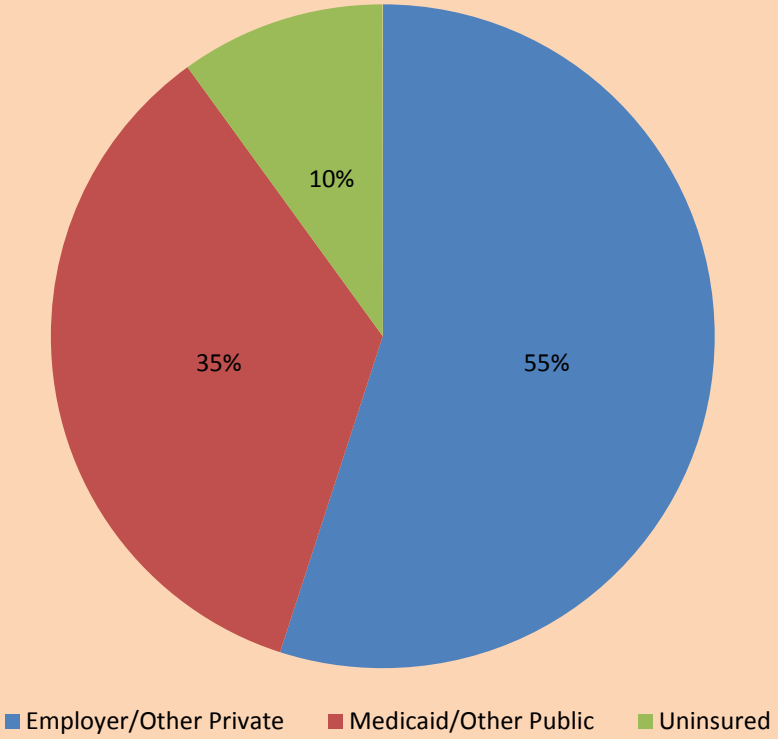
Background and Context

- CHIPRA's Title IV signals a new day for children's healthcare quality measurement in the U.S.
- AHRQ is partnering with CMS on identification and development of children's healthcare quality measures
  - Phase I-- Identification of an initial core measurement set for voluntary use by Medicaid and CHIP programs-- is completed
  - Phase II – the Pediatric Quality Measures Program (Sec. 1139A(b) of Title XI (42 USC 1301 et seq.) began in January 2011 (PQMP).
    - Improved core measures are to be published annually beginning January 1, 2013.

www.ahrq.gov/CHIPRA

Slide courtesy of Denise Dougherty, AHRQ

Health Insurance for Children, 2009



Source: Kaiser Commission for Medicaid and Uninsured

PQMP Goals

CHIPRA Title IV Sec. 401 which amended Title XI (42 USC 1301 et seq.) by adding the following new section: Sec. 1139A (b).

- The Secretary shall establish a pediatric quality measures program to:
  - **Improve and strengthen …**children's health care quality measures;
  - **Expand on existing pediatric quality measures** .. and advance [their] development; and
  - **Increase the portfolio** of evidence-based, consensus pediatric quality measures available to public and private purchasers of children's health care services, providers, and consumers.

Courtesy of Denise Dougherty, AHRQ

Definitions of Quality

- IOM – The degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.
- Doing the right thing, well, for the right person, at the right time

The Constituents of Quality

- Donabedian
  - Structure / System
  - Process
  - Outcomes
- Coordination of care
- Patient experience of care

Attributes of Quality (IOM)

Health care should be:

- Safe
- Effective
- Patient-centered
- Timely
- Efficient
- Equitable

Desirable Attributes of Quality Measures

- Individual Measures
  - Reliable
  - Valid
  - Well-specified
  - Usable/feasible
  - Useful/actionable
- Portfolio of Measures
  - enhance innovation
  - expose new clinical areas to measurement
  - Improve health and health care

Purposes of Quality Measurement

- Accountability
- Quality Improvement
- Monitoring
- Learning

Simple Model

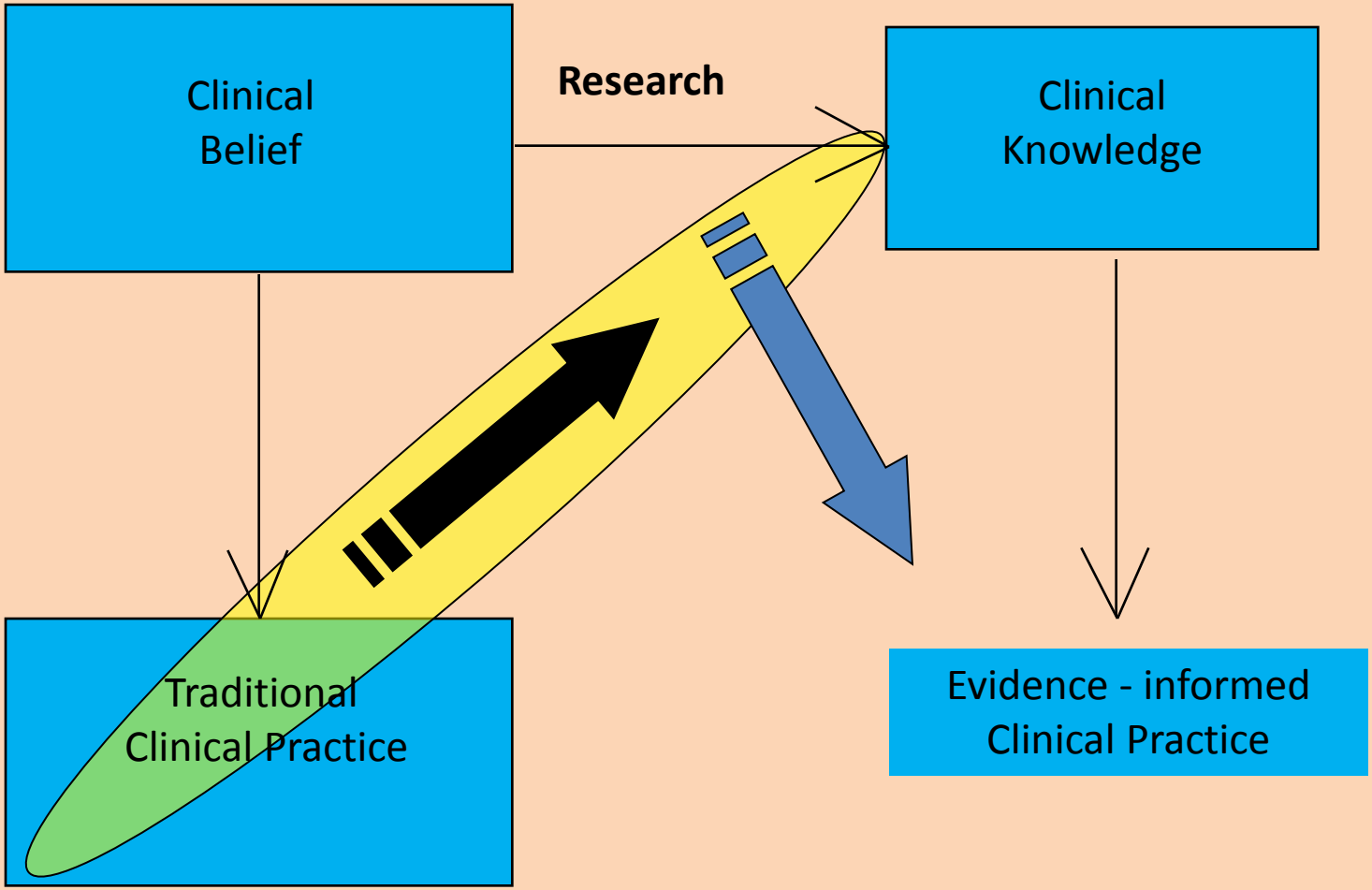
		Believed useful ?	
Research Corroborated ?		Yes	No
	Yes	a	b
	No	c	d

Evidenced based = a + b
Traditional practice = a + c

Popper: Confirming evidence should not count *except when it is the result of a genuine test of the theory*; [by] a serious but unsuccessful attempt to falsify the theory. ("I now speak in such cases of 'corroborating evidence.'")

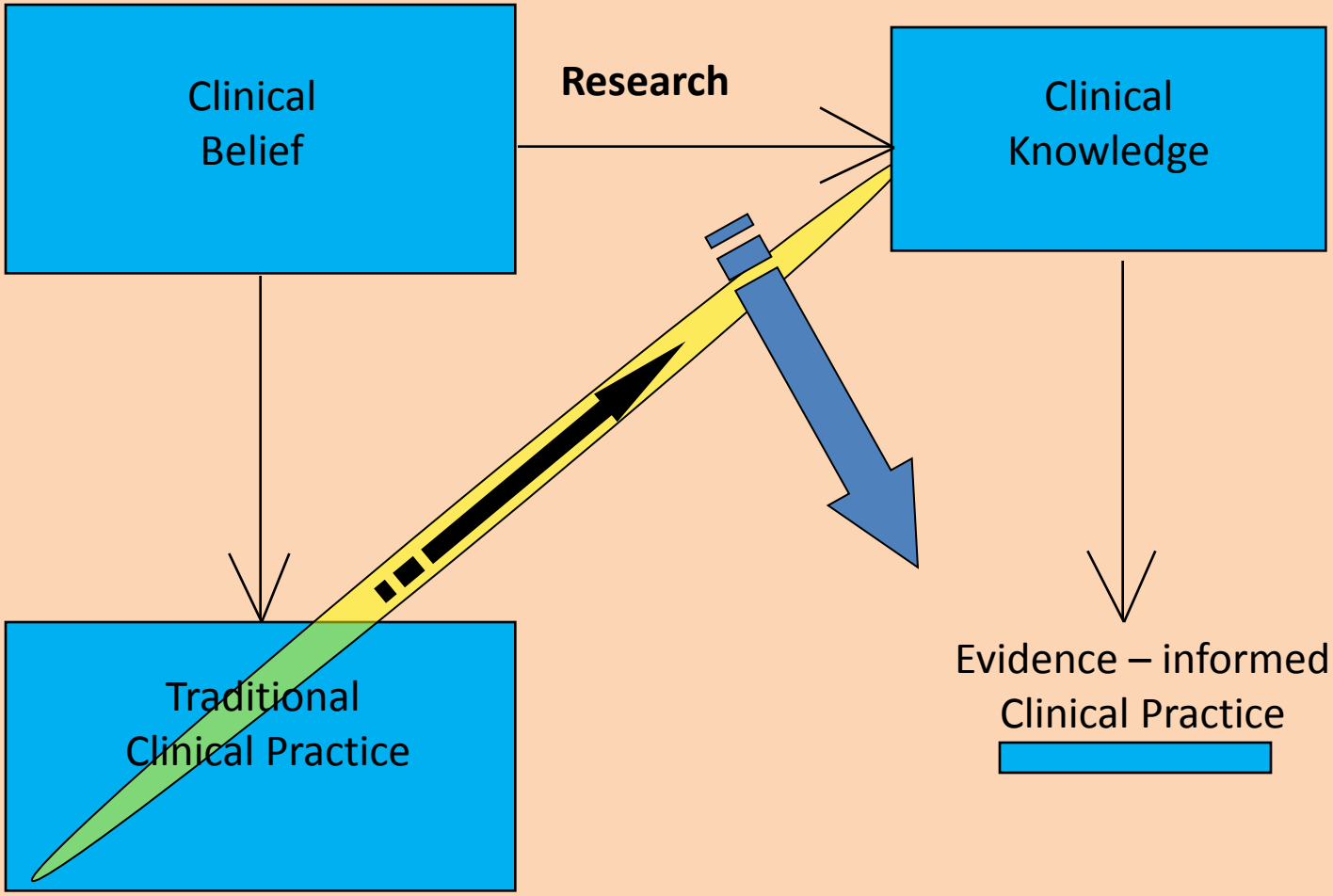
Kleinman, AJPM 1998

Adult Medicine



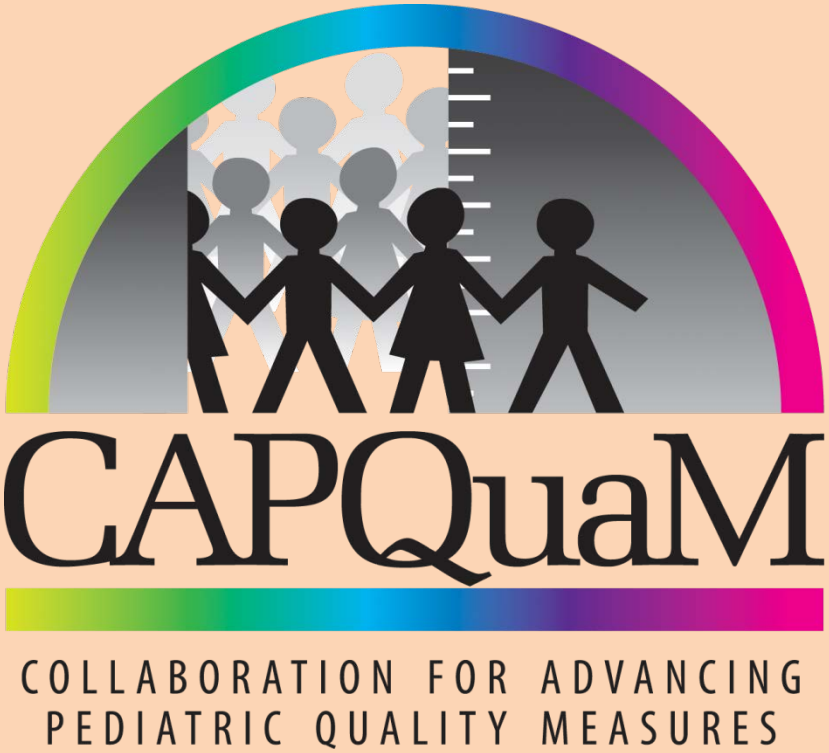
Kleinman LC, Am J Prev Med, 1998

Evidence is particularly limited when it comes to pediatric care



CAPQuaM
COLLABORATION FOR ADVANCING PEDIATRIC QUALITY MEASURES

The Mount Sinai Collaboration for Advancing Pediatric Quality Measures (CAPQuaM)



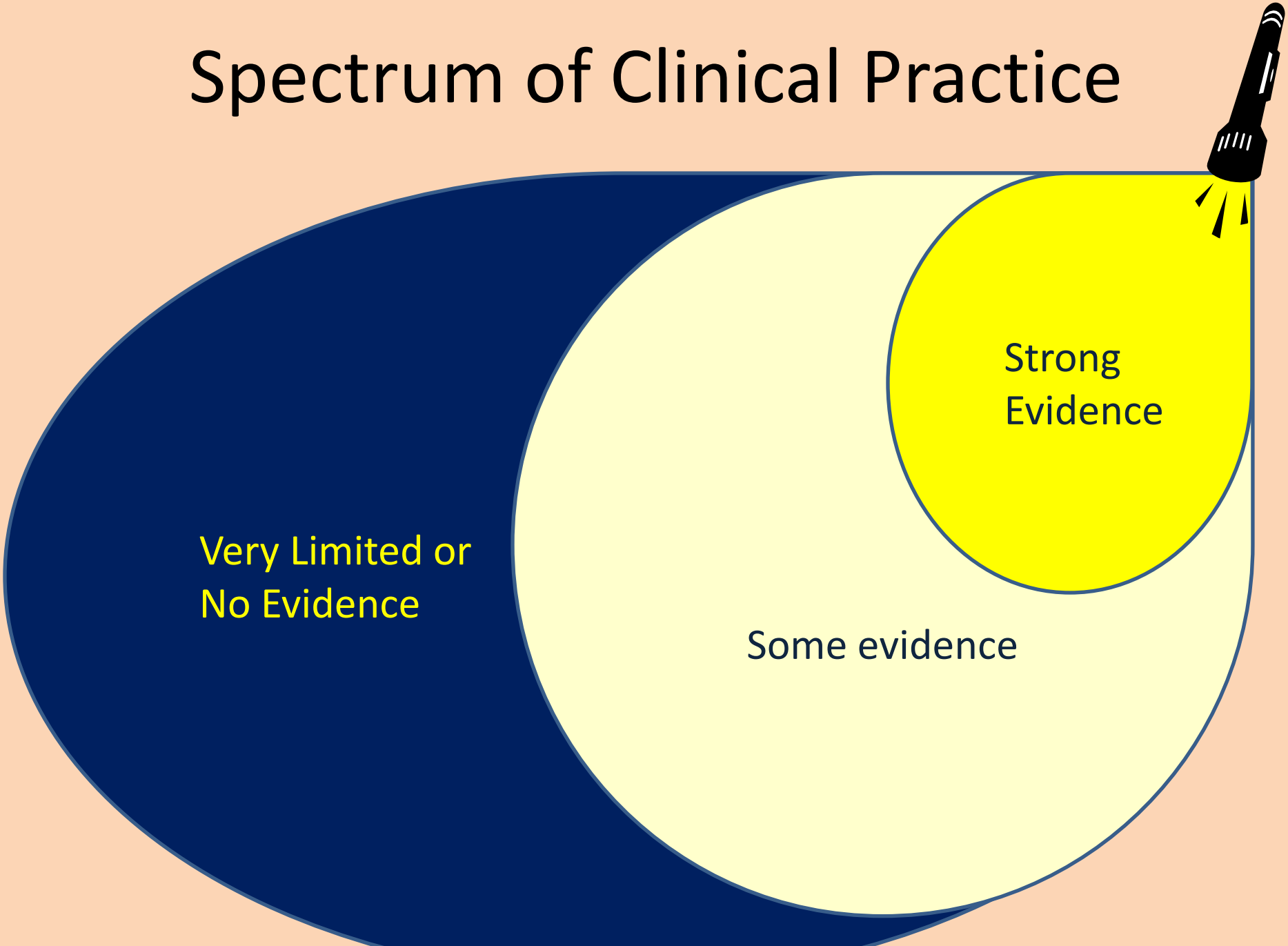
CAPQuaM Principles

- It is possible to develop excellent quality measures even when there is meaningful uncertainty about clinical practice
- Medicine is a clinical practice for which the evidence is rarely dispositive for a specific patient
- There exist overuse, underuse, and misuse and all should be open to measurement

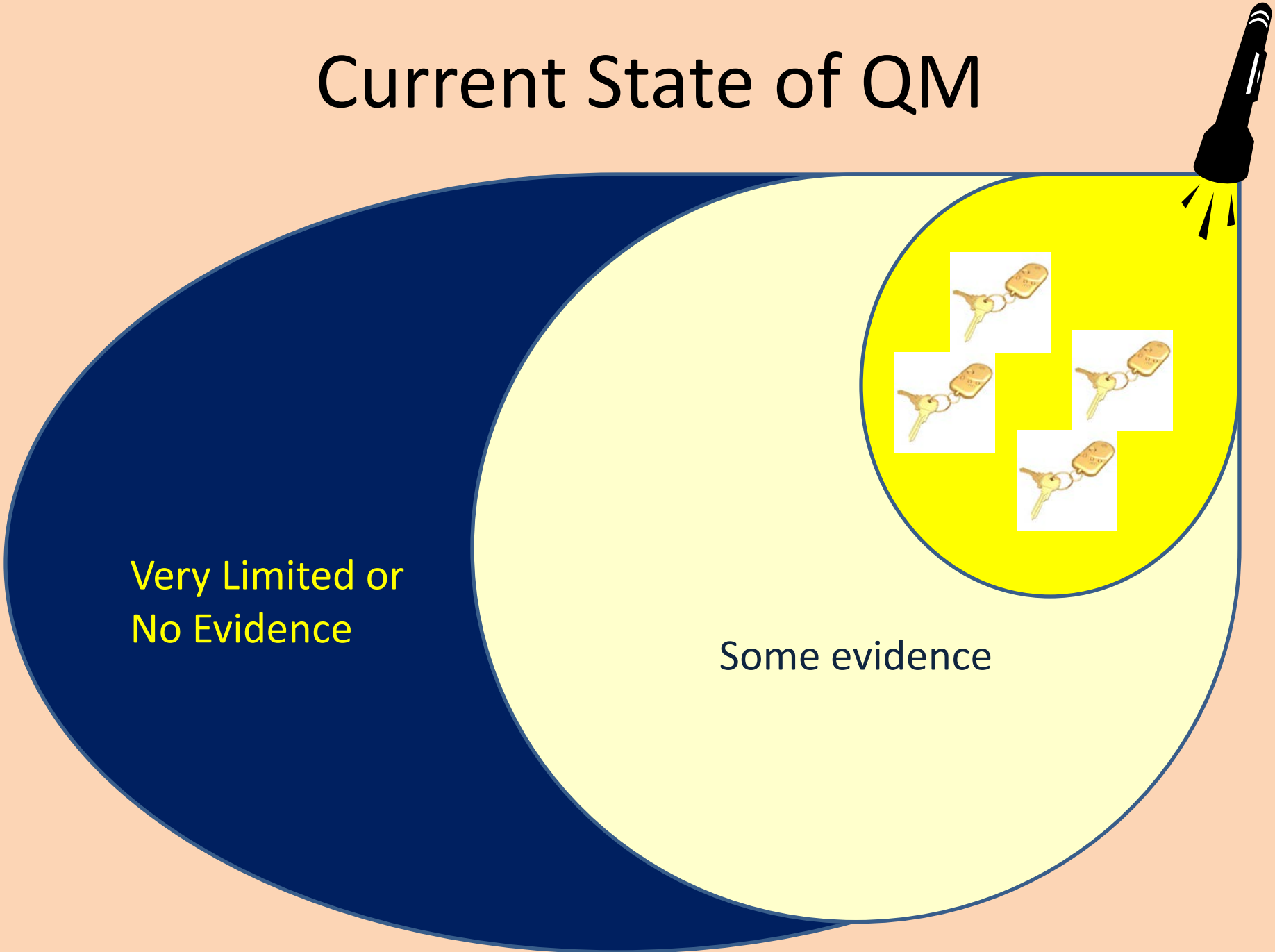
Better Quality Measures are one of the keys to better health and health care

CAPQuaM
COLLABORATION FOR ADVANCING PEDIATRIC QUALITY MEASURES

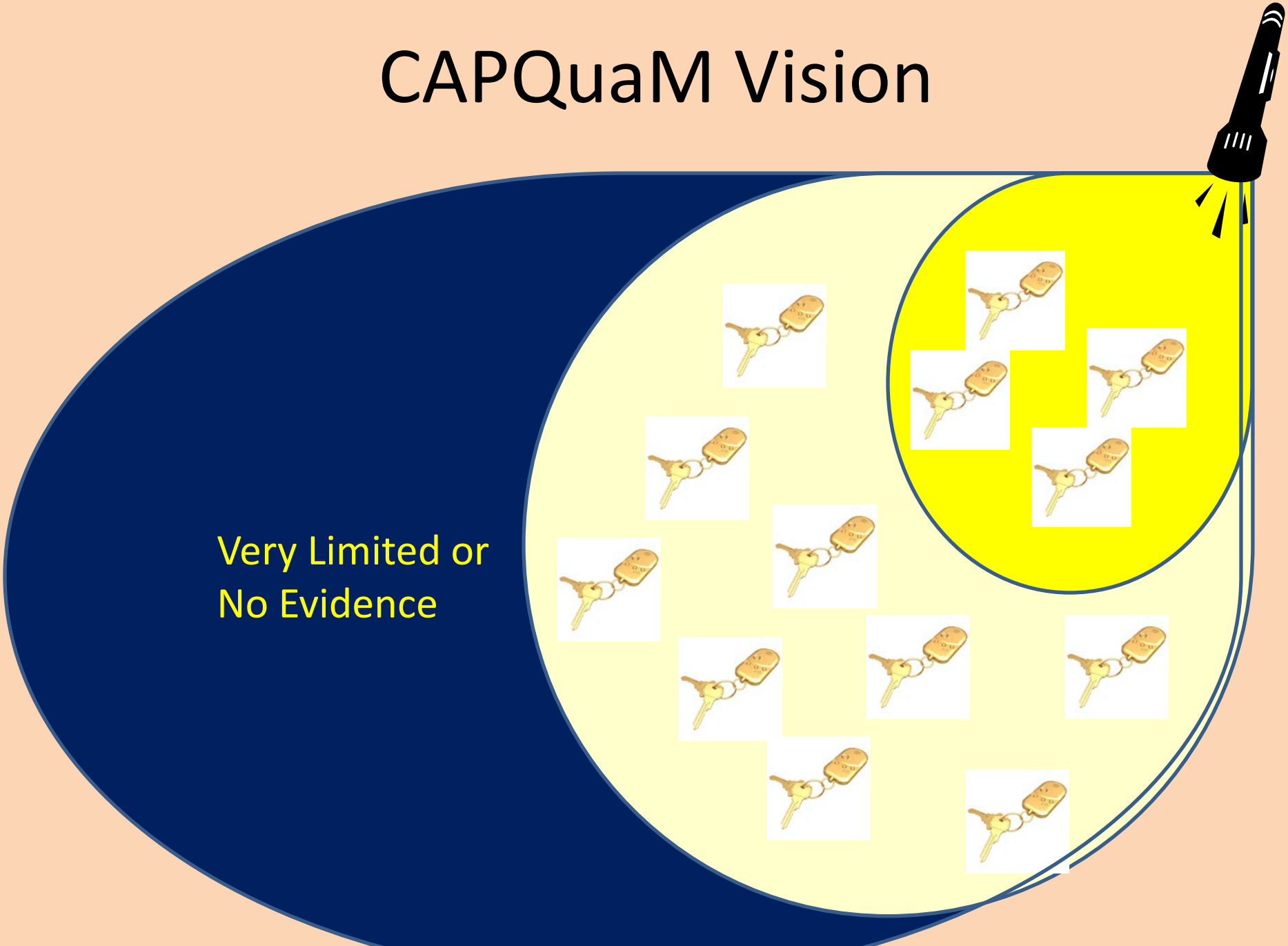
Spectrum of Clinical Practice



Current State of QM



CAPQuaM Vision



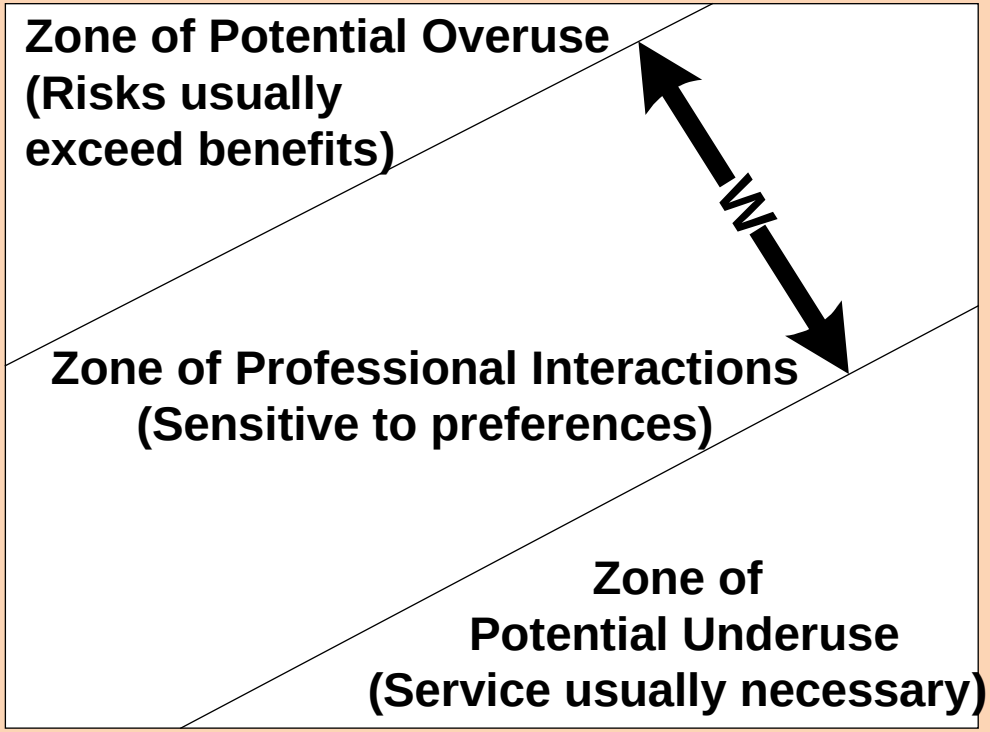
Our Approach

- Build Coalition of Strong Institutional Partners
  - Accreditors (TJC, NCQA)
  - Clinicians (AAP, AAFP, ACOG)
  - Consumers (Consumer Reports, IPFCC, NAMI)
  - Insurers
- Offered things of opposing value(s)
  - Overuse on the one hand
  - Validation of clinical process on the other

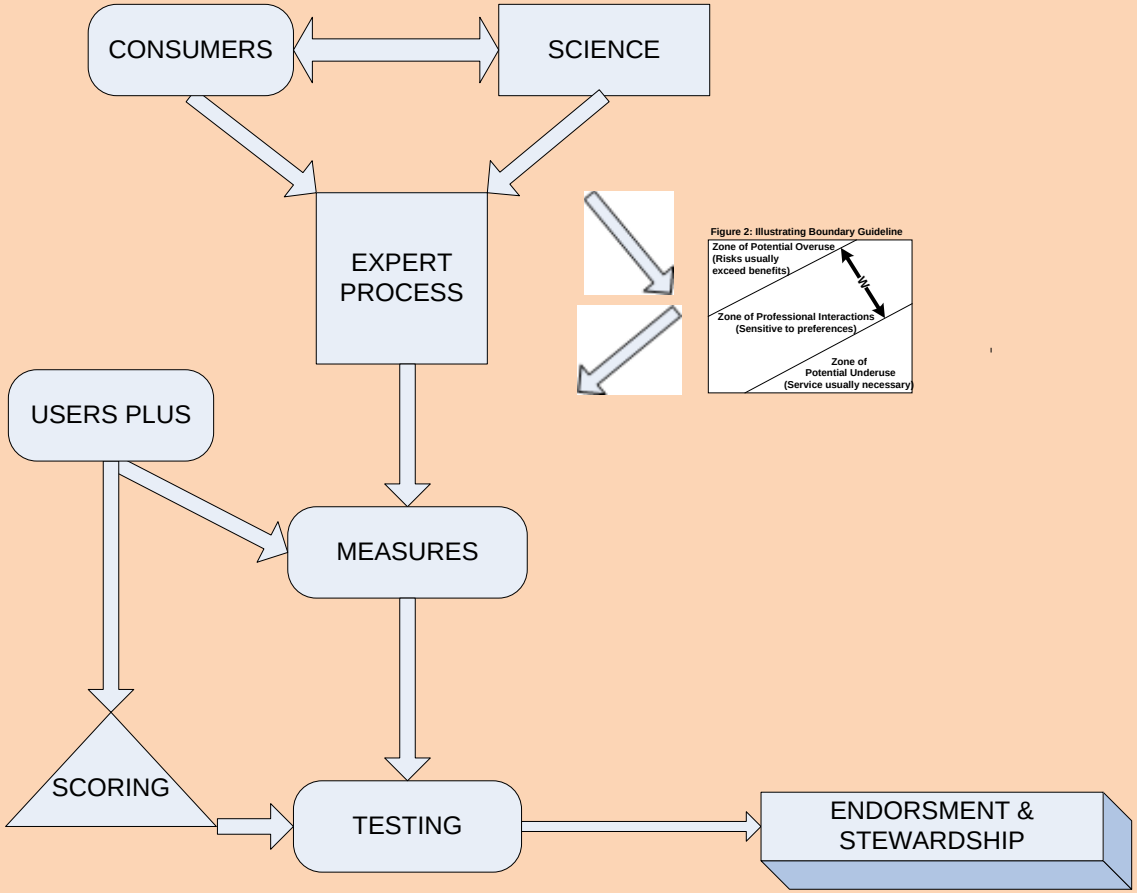
Explicitly incorporate uncertainty

- Boundary Guideline
  - Incorporates evidence and uncertainty

Figure 2: Illustrating Boundary Guideline



Develop Consensus around the Process, not the Measure



Mount Sinai Collaboration for Advancing Pediatric Quality Measures (CAPQuaM)

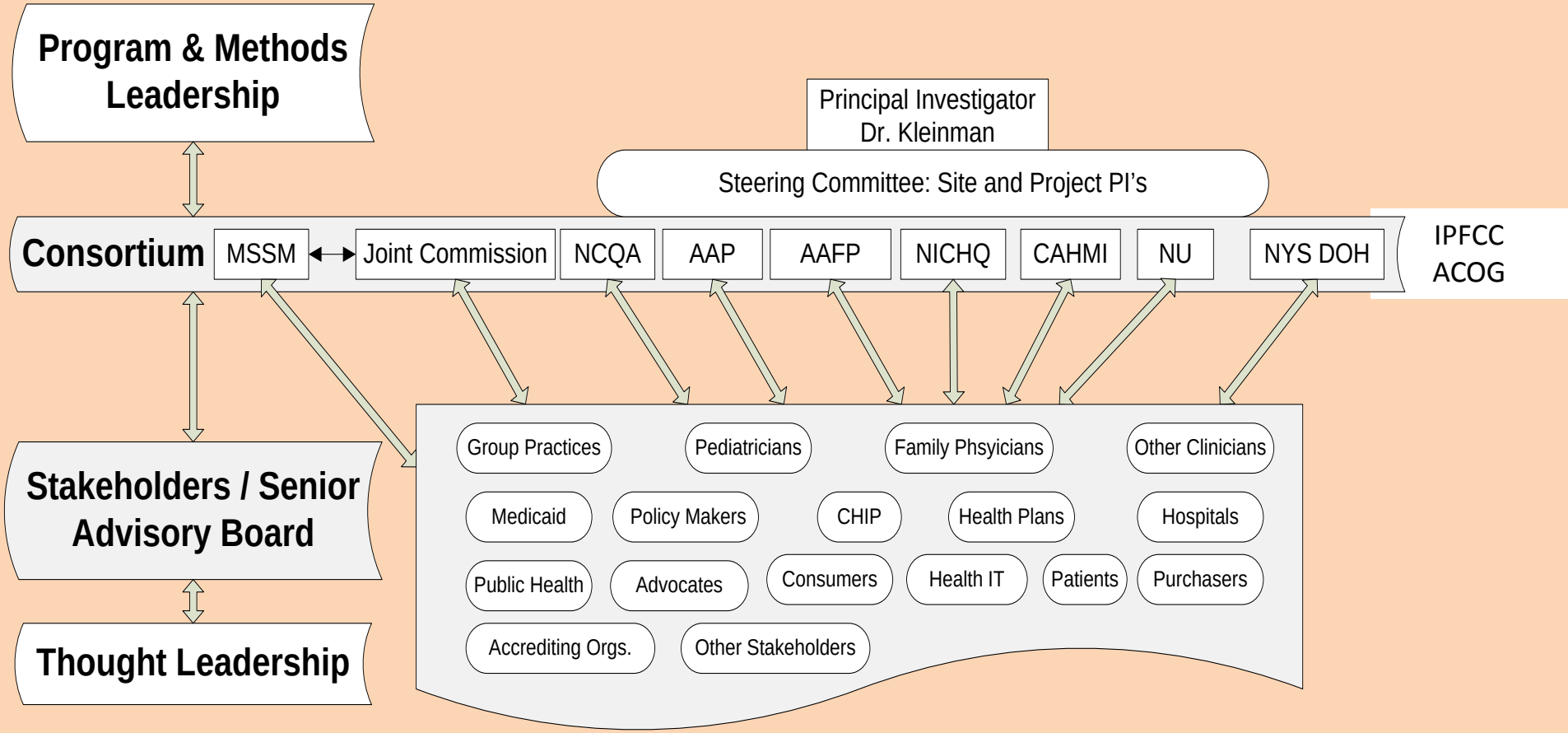


Table 2. MSSM CAPQuaM Steering Committee and Senior Advisors			
Steering Committee	**Organization**	**Senior Advisors**	**Organization**
Christina Bethell, PhD, MBA, MPH	CAHMI, OHSU	Mark Chassin, MD, MPH, MPP	TJC
Marla Clayman, PhD	Northwestern	John Clarke, MD	ECRI, PA Patient Safety Authority
Foster C. Gesten, MD	OHIP, NYS DOH	Martin Hatlie, JD	Partnership 4 Pt. Safety, Consumers Advancing Pt Safety
Charles J. Homer, MD, MPH	NICHQ	Tony Hope, BM BCh, PhD	Oxford U.
Jerod M. Loeb, PhD	TJC	Beverly K. Johnson	Institute for Family Centered Care
Lynn Olson, PhD	AAP	Marilyn Kacica, MD	NYS DOH DFH
Wilson Pace, MD	AAFP	Steve Kairys, MD	AAP/QuIIN
Mary Barton, MD	NCQA	Barbara Kupferman	UHC/Americhoice
Elizabeth Howell, MD	MSSM	Marc Lashley, MD,	Allied Pediatrics
Harold Kaplan, MD	MSSM	Gregory Pawlson, MD	BC/BS Association
Lawrence Kleinman, MD, MPH	MSSM	Laurel Pickering	Northeast BGH
Ira Nash, MD	MSSM	Harold Pincus, MD	Columbia U, NYPI
Eyal Shemesh, MD	MSSM	Eric A. Rose, MD	MSSM
Senior Advisors	**Organization**	Robert St. Peter, MD, MPH	Kansas Health Institute
Arthur Aufses, MD	MSSM	John Santa, MD	Consumers Union
Anne C. Beal, MD, MPH	Aetna Foundation	Shoshanna Sofaer, Dr PH	CUNY Baruch
David Baker, MD, MPH	Northwestern	Ruth Stein, MD	CH @ Montefiore
Scott Breidbart, MD	Empire BCBS	Jeff Terry	GE Healthcare
Wendy Brennan, MS	NAMI- NYC Metro	Paul Wise, MD	Stanford University

Assigned Measures, Phase 1

- Availability of High Risk Ob Care
- Inpatient Perinatal
  - Temperature on admission to NICU
- ER Visits for Asthma
  - As an indicator of chronic asthma care
  - As an indicator of adequacy of primary care

Stakeholder Engagement

- Consumer Stakeholders
  - Share their beliefs, priorities, values based upon relevant experiences (CFLR is novel)
- Clinician Stakeholders
  - Share their beliefs priorities, values and relevant experiences
  - Staff expert panels to develop criteria to support boundary guideline
- Organizational Stakeholders
  - Assist with specification of measures
  - Plan for interpretation of measures

Institutional Stakeholder Contributions

- Advise & engage
- Assist with translating boundary guideline to measure specifications
- Inform the scoring process
- Prioritize data elements for collection and feasibility

Expert Panel (EP) Contribution

- Integrates the input from the literature and stakeholders with their own expertise to
  - Define clinical standards / criteria
  - Assess the validity / importance of specific constructs within the clinical framework
  - Assess the value of specific items, measures. specifications, etc as appropriate
- The final arbiter on clinical decisions

EP Composition

- Multidisciplinary
- Academic and Community Settings
- Geographically Diverse

EP Method

- Adopted from the RAND UCLA Appropriateness Method (RUAM)
- RAND 2-round Modified Delphi Process
  - Round 1 Telephone
  - Round 2 Face-to-face
- CAPQuaM adds:
  - Input from clinician and consumer stakeholders
  - Post processing and potential third round (only if needed)

EP Process

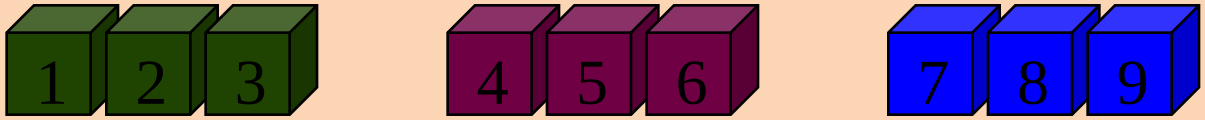
- Scientific Team organizes questions for discussion in the form of “scenarios”
- Scenarios may be true clinical circumstances, constructs or survey questions for rating importance, or other formulations that allow panel to assess validity, importance, or clinical judgment
- Scenarios may be organized into “chapters” and “verse” to help to promote efficient rating process

EP Role in 360° Method

- EP owns the clinical importance of specific constructs
  - Provides expert judgment as a path to validity
  - Advise regarding editing/revising scenarios
  - May advise regarding specifications
- Stakeholders (Senior Advisors) own the final specifications and scoring strategies
- Scientific Team frames, interprets, organizes, provides feedback and organizes testing

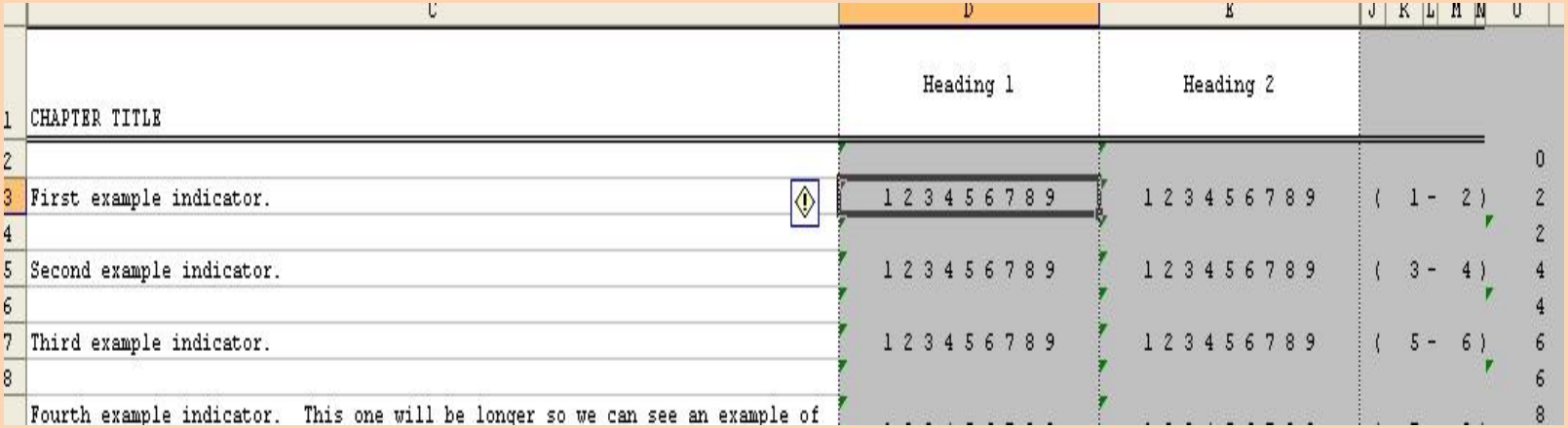
EP Member Role in the Process

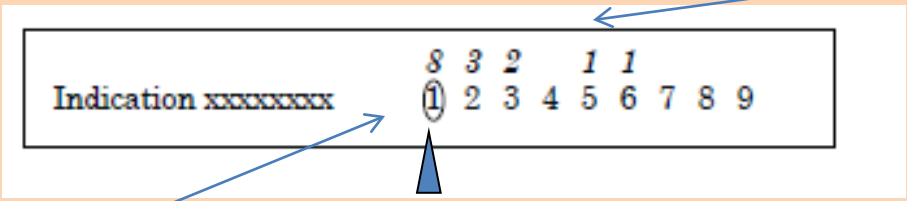
- Examine Literature Review
- Review Summary of Stakeholder Input
- Work with team to revise scenarios
- Incorporate your judgment
  - 2 stage rating: Telephone & In-Person
- Scenarios rated on 9 point scale



Low Rating EQUIVOCAL High Rating

EP Voting Method



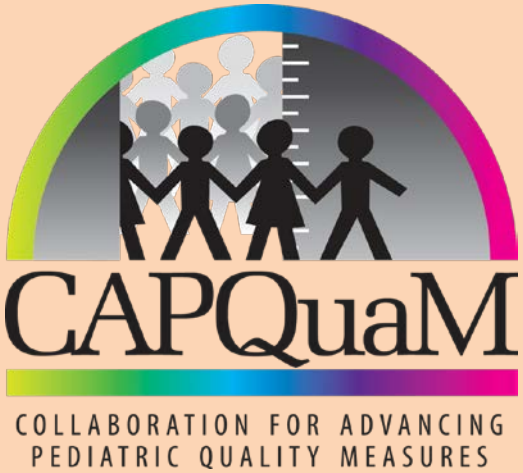


Ratings 1-9

Panelist vote is circled

Summary of votes:

- Eight votes for 1
- Three votes for 2
- Two votes for 3
- One vote for 5
- One vote for 6



Thank you for participating with the CAPQuaM on this important project

We will be in touch soon about the next call and in-person meeting details.

Any questions?

Please contact: capquam@mountsinai.org
Barbara Rabin 212-659-8396
Larry Kleinman Lawrence.Kleinman@mssm.edu

Appendix D

2nd Round EP Ratings Summary

CAPQuaM

COLLABORATION FOR ADVANCING PEDIATRIC QUALITY MEASURES

Asthma

Dr. E. Allen
Dr. M. Cabana
Dr. J. Connel
Dr. C. Dinakar
Dr. D. Gracy
Dr. C. Macias
Dr. S. Miner
Dr. S. Teach
Dr. B. Yawn

Chapter 1

#	Scenario	Frequency									Median	Variation
		1	2	3	4	5	6	7	8	9		
1.01	Having established asthma prior to the ED visit is an inclusion criterion for this measure	0	0	0	0	1	0	2	0	6	9	0.9
		1	2	3	4	5	6	7	8	9		
1.02	Asthma is established by a single prior hospital admission with asthma as the primary discharge diagnosis	0	0	0	0	1	0	3	1	4	8	1.1
		1	2	3	4	5	6	7	8	9		
1.03	Asthma is established by a single prior hospital admission with asthma as the secondary discharge diagnosis	0	0	0	1	1	1	2	2	2	7	1.3
		1	2	3	4	5	6	7	8	9		
1.04	Asthma is established by a single prior hospital admission with asthma as the third discharge diagnosis	0	0	0	3	1	0	1	3	1	7	1.8
		1	2	3	4	5	6	7	8	9		
1.05	Asthma is established by a single prior hospital admission with asthma as any discharge diagnosis	0	1	1	1	0	0	1	3	2	8	2.0
		1	2	3	4	5	6	7	8	9		
1.06	A single admission is not sufficient to establish the presence of asthma.	3	1	2	0	1	0	2	0	0	3	1.9
		1	2	3	4	5	6	7	8	9		
1.07	Asthma is established by a single prior ED visit with asthma as the primary discharge diagnosis	1	1	0	1	0	0	5	0	1	7	1.8
		1	2	3	4	5	6	7	8	9		
1.08	Asthma is established by a single prior ED visit with asthma as the secondary discharge diagnosis	2	0	1	0	1	1	3	1	0	6	2.1
		1	2	3	4	5	6	7	8	9		
1.09	Asthma is established by a single prior ED visit with asthma as any discharge diagnosis	1	2	0	1	0	1	2	2	0	6	2.3
		1	2	3	4	5	6	7	8	9		
1.10	Asthma is established by a single prior ED visit with asthma as the secondary discharge diagnosis	1	1	1	2	0	0	4	0	0	4	2.0

		1	2	3	4	5	6	7	8	9		
1.11	Asthma is established by a single prior ED visit with asthma as any discharge diagnosis	2	1	1	0	0	1	2	2	0	6	2.6
1.12	A single prior ED visit with asthma is not sufficient to establish the diagnosis of asthma.	2	0	3	0	0	0	0	2	2	3	2.9
1.13	Asthma is established by a single outpatient visit with asthma as a primary diagnosis	1	0	4	0	0	1	2	0	1	3	2.1
1.14	Asthma is established by a single outpatient visit with asthma as a diagnosis.	1	1	3	0	2	0	1	1	0	3	1.8
1.15	Asthma is established by 2 or more outpatient visits with asthma as a diagnosis.	0	1	1	0	1	1	3	0	2	7	1.8
1.16	Asthma is established by 3 or more outpatient visits with asthma as a diagnosis	0	1	1	0	0	0	2	2	3	8	1.8
1.17	Asthma is not established until 4 or more outpatient visits with asthma s a diagnosis	3	1	2	1	0	0	0	2	0	3	2.0
1.18	Asthma related medication use helps to establish the presence of asthma.	0	0	1	0	1	0	4	2	1	7	1.1
1.19	Prescription for leukotriene inhibitors are typically asthma related..	0	0	1	0	6	2	0	0	0	5	0.4
1.20	Prescriptions for beta 2 agonists are typically asthma related.	0	1	0	0	2	1	1	3	1	7	1.7
1.21	Prescriptions for inhaled steroids are typically asthma related.	0	0	0	0	1	0	2	3	3	8	0.9
1.22	Oral steroid bursts are typically asthma related.	0	0	0	0	3	2	3	1	0	6	0.9

		1	2	3	4	5	6	7	8	9		
1.23	In order to establish a diagnosis of asthma, a child should experience a total of at least 2 outpatient visits and asthma related prescriptions filled.	0	1	1	0	1	1	4	1	0	7	1.4
1.24	In order to establish a diagnosis of asthma, a child should experience a total of at least 3 outpatient visits and asthma related prescriptions filled.	1	1	0	0	1	0	3	0	3	7	2.1
1.25	In order to establish a diagnosis of asthma, a child should experience a total of at least 4 outpatient visits and asthma related prescriptions filled.	2	0	0	0	1	1	1	1	3	7	2.4
1.26	Filled prescriptions should not be considered when establishing the presence of asthma	4	1	2	0	1	0	0	0	0	1.5	1.0
1.27	Children with a diagnosis of COPD with chronic aspiration should be excluded from this measure.	0	0	0	0	0	0	0	2	7	9	0.2
1.28	Children with a diagnosis of COPD should be excluded from this measure.	0	0	0	0	0	0	2	1	6	9	0.6
1.29	Children with a diagnosis of cystic fibrosis should be excluded from this measure.	0	0	0	0	0	0	0	1	8	9	0.1
1.30	Children with diagnoses codes 49320, 49321, and 49322 (chronic obstructive asthma) should be included in this measure.	0	0	0	0	1	1	1	1	5	9	1.1
1.31	Children with a diagnosis of emphysema and chronic aspiration should be excluded.	0	0	0	0	0	0	0	3	6	9	0.3
1.32	Children with a diagnosis of emphysema should be excluded	0	0	0	0	0	0	0	3	6	9	0.3

		1	2	3	4	5	6	7	8	9		
1.33	The time frame for establishing a diagnosis of asthma extends before the reporting year.	0	0	0	0	1	0	3	1	4	8	1.1
1.34	The diagnosis of asthma can be established by a parent reporting that they were aware the child has asthma.	0	1	1	1	1	0	4	0	1	7	1.8
1.35	The diagnosis of asthma can be established by a parent reporting that the child was diagnosed by a clinician as having asthma.	0	1	0	0	0	1	3	1	3	7	1.4
1.36	The diagnosis of asthma can be established by the child having been provided an asthma action plan.	0	0	0	0	0	2	3	1	3	7	1.0
1.37	Referral to a multidisciplinary program for asthma establishes the diagnosis of asthma.	0	0	0	0	1	1	2	2	3	8	1.1
1.38	This measure should include children over 2	1	0	0	0	1	0	2	3	2	8	1.6
1.39	This measure should include children over 3	1	0	0	0	1	0	0	2	5	9	1.6
1.40	This measure should include children over 4	0	0	0	1	1	0	0	1	6	9	1.1
1.41	This measure should include children over 5	0	0	0	0	0	0	0	1	8	9	0.1
1.42	This measure should include children over 6	0	0	0	0	0	0	0	0	9	9	0.0
1.43	The upper age limit for this measure should be children through their 16th birthday	1	3	1	0	1	1	0	0	2	3	2.4
1.44	The upper age limit for this measure should be children through their 17th birthday	1	3	1	0	1	0	0	1	2	3	2.7

		1	2	3	4	5	6	7	8	9		
1.45	The upper age limit for this measure should be children through their 18th birthday	0	0	0	0	1	0	3	2	3	8	1.0
1.46	The upper age limit for this measure should be children through their 19th birthday	0	4	0	1	1	0	2	1	0	4	2.1
1.47	The upper age limit for this measure should be children through their 20th birthday	0	4	0	1	1	0	2	1	0	4	2.1
1.48	The upper age limit for this measure should be children through their 21st birthday	0	3	0	1	0	0	0	3	2	8	2.7
1.49	It is optimal to group children below age 5 together for reporting purposes.	0	1	1	0	0	1	3	2	1	7	1.6
1.50	It is optimal to group children below age 6 together for reporting purposes.	1	2	0	0	0	2	1	3	0	6	2.2
1.51	For reporting purposes, it is optimal to include children through age 11 with younger (school age) children.	0	0	0	0	0	0	2	2	5	9	0.7
1.52	For reporting purposes, it is optimal to include children through age 12 with younger (school age) children.	1	2	1	2	1	1	0	1	0	4	1.7
1.53	For reporting purposes, it is optimal to include children through age 13 with younger (school age) children.	1	4	1	2	1	0	0	0	0	2	1.0
1.54	For reporting purposes, it is optimal to include children through age 13 with younger (school age) children.	1	4	1	2	1	0	0	0	0	2	1.0
1.55	For reporting purposes, adolescents 19-21 should be grouped with adolescents under 18.	2	1	2	0	2	1	0	0	1	3	2.0

		1	2	3	4	5	6	7	8	9		
1.56	For the purposes of this measure, only ED visits with asthma as the primary diagnosis are eligible for inclusion.	0	1	1	0	2	1	3	1	0	6	1.6
1.57	For the purposes of this measure, only ED visits with asthma as the primary or secondary diagnosis are eligible for inclusion.	0	0	0	0	2	4	1	2	0	6	0.8
1.58	For the purposes of this measure, all ED visits with asthma as a diagnosis are eligible for inclusion.	0	0	2	1	3	1	1	1	0	5	1.2
1.59	For the purposes of this measure, a treatment for asthma must be provided or prescribed in order for the ED visit to be eligible for inclusion.	0	1	1	0	1	0	1	2	3	8	2.0

Chapter 2

#	Scenario	Frequency									Median	Variation
		1	2	3	4	5	6	7	8	9		
2.01	A PRAM score (Pediatric Respiratory Assessment Measure) may be used to establish that the ED was an appropriate level of care.	1	0	0	1	1	2	1	2	1	6	1.8
		1	2	3	4	5	6	7	8	9		
2.02	An Asthma Severity Score may be used to establish that the ED was an appropriate level of care.	2	0	0	0	2	2	1	1	1	6	2.0
		1	2	3	4	5	6	7	8	9		
2.03	A Clinical Asthma Score (CAS) may be used to establish that the ED was an appropriate level of care.	0	0	0	0	3	2	1	2	1	6	1.2
		1	2	3	4	5	6	7	8	9		
2.04	A Pulmonary Index score may be used to establish that the ED was an appropriate level of care.	1	0	0	0	3	1	1	2	1	6	1.8
		1	2	3	4	5	6	7	8	9		
2.05	A Pulmonary Score (PS) may be used to establish that the ED was an appropriate level of care.	1	0	0	0	3	1	1	2	1	6	1.8
		1	2	3	4	5	6	7	8	9		
2.06	A Pediatric Asthma Severity Score (PASS) may be used to establish that the ED was an appropriate level of care.	1	0	0	0	3	1	1	2	1	6	1.8
		1	2	3	4	5	6	7	8	9		
2.07	Wheezing on presentation to the ED establishes that the ED was an appropriate level of care for that child.	0	0	3	0	4	1	1	0	0	5	1.0
		1	2	3	4	5	6	7	8	9		
2.08	Retractions or labored breathing during the ED visit establishes that the ED was an appropriate level of care for that child.	0	0	0	0	1	1	2	3	2	8	1.0
		1	2	3	4	5	6	7	8	9		
2.09	Decreased breath sounds establish that the ED was an appropriate level of care.	0	0	0	0	3	1	1	0	4	7	1.7

		1	2	3	4	5	6	7	8	9		
2.10	Markedly decreased breath sounds establish that the ED was an appropriate level of care.	0	0	0	0	1	1	1	2	4	8	1.1
		1	2	3	4	5	6	7	8	9		
2.11	The panel should establish age specific thresholds for respiratory rates, over which an ED would be considered to be an appropriate level of care.	1	0	1	1	2	0	3	1	0	5	1.8
		1	2	3	4	5	6	7	8	9		
2.12	Obtaining an chest x-ray in the ED establishes the ED as an appropriate level of care for that child.	2	4	2	0	0	0	1	0	0	2	1.0
		1	2	3	4	5	6	7	8	9		
2.13	Obtaining an ABG in the ED establishes the ED as an appropriate level of care for that child.	2	0	1	0	0	0	0	3	3	8	2.4
		1	2	3	4	5	6	7	8	9		
2.14	Oxygen saturation less than 85% establishes that the ED was an appropriate level of care.	0	0	0	0	0	0	1	0	8	9	0.2
		1	2	3	4	5	6	7	8	9		
2.15	Oxygen saturation less than 90% establishes that the ED was an appropriate level of care for that child.	0	0	0	0	0	0	2	2	5	9	0.7
		1	2	3	4	5	6	7	8	9		
2.16	Oxygen saturation less than 95% establishes that the ED was an appropriate level of care for that child.	0	1	1	0	3	0	3	1	0	5	1.6
		1	2	3	4	5	6	7	8	9		
2.17	Receipt of one parenteral treatment establishes that the ED was an appropriate level of care for that child.	0	2	4	0	1	1	0	0	1	3	1.4
		1	2	3	4	5	6	7	8	9		
2.18	Receipt of more than one parenteral treatment establishes that the ED was an appropriate level of care for that child.	0	0	4	0	1	0	3	0	1	5	2.0

		1	2	3	4	5	6	7	8	9		
2.19	Hospitalization following the ED visit establishes that the ED was an appropriate level of care for that child.	0	0	0	0	1	1	0	1	6	9	0.9
2.20	An ED visit less than one week following a previous ED visit in a child with asthma establishes that the ED was an appropriate level of care for that child.	1	2	2	0	1	1	2	0	0	3	1.9
2.21	An ED visit less than 72 hours following a previous ED visit in a child with asthma establishes that the ED was an appropriate level of care for that child.	1	1	2	1	1	1	2	0	0	4	1.8
2.22	Prescription of an oral steroid burst establishes that the ED was an appropriate level of care for that child.	1	0	2	0	2	1	1	1	1	5	2.0
2.23	An ED visit less than one week following a hospital discharge in a child with asthma establishes that the ED was an appropriate level of care for that child.	0	1	4	0	2	1	1	0	0	3	1.3
2.24	An ED visit less than 72 hours following a hospital discharge in a child with asthma establishes that the ED was an appropriate level of care for that child.	0	1	4	0	2	0	2	0	0	3	1.4
2.25	A specialty consultation in the ED establishes that the ED was an appropriate level of care for that child.	0	0	0	1	0	1	3	1	2	7	1.0
2.26	Homelessness establishes that the ED was an appropriate level of care for that child.	0	2	3	0	3	1	0	0	0	3	1.2

		1	2	3	4	5	6	7	8	9		
2.27	Parent report of their child being sick enough to need the ED establishes that the ED was an appropriate level of care for that child.	0	0	2	1	2	3	1	0	0	5	1.1
		1	2	3	4	5	6	7	8	9		
2.28	Parent report of wheezing establishes that the ED was an appropriate level of care for that child.	0	2	3	1	2	0	1	0	0	3	1.2
		1	2	3	4	5	6	7	8	9		
2.29	Parent report of difficulty breathing establishes that the ED was an appropriate level of care for that child.	0	1	2	0	2	0	0	4	0	5	2.1
		1	2	3	4	5	6	7	8	9		
2.30	Parent report of previous rapid deterioration after similar symptoms establishes that the ED was an appropriate level of care for that child.	0	0	1	0	1	0	1	5	0	8	1.0
		1	2	3	4	5	6	7	8	9		
2.31	Parent report that the PCP is generally unavailable for urgent asthma care establishes that the ED was an appropriate level of care for that child.	1	0	2	2	0	1	2	0	1	4	2.0
		1	2	3	4	5	6	7	8	9		
2.32	Parent report of inability to reach the PCP during the current event establishes that the ED was an appropriate level of care for that child.	1	0	0	3	1	0	2	1	1	5	2.0
		1	2	3	4	5	6	7	8	9		
2.33	Parent report that they were referred into the ED by phone contact a clinician establishes that the ED was an appropriate level of care for that child.	0	0	0	1	0	1	2	4	1	8	1.0
		1	2	3	4	5	6	7	8	9		
2.34	Parent report that they were referred to the ED after being seen by a clinician establishes that the ED was an appropriate level of care for that child.	0	0	0	0	0	0	1	2	6	9	0.4

		1	2	3	4	5	6	7	8	9		
2.35	Parent report that the child did not respond to a dose of a rescue medication establishes that the ED was an appropriate level of care for that child.	0	0	3	0	2	0	2	2	0	5	1.8
2.36	Parent report that the child did not respond to 2 or more doses of a rescue medication establishes that the ED was an appropriate level of care for that child.	0	0	1	0	3	0	1	2	2	7	1.8
2.37	Parent report that they ran out of maintenance medication establishes that the ED was an appropriate level of care for that child.	2	2	3	1	1	0	0	0	0	3	1.0
2.38	Parent report that they ran out of rescue medication establishes that the ED was an appropriate level of care for that child.	1	2	4	0	1	1	0	0	0	3	1.0
2.39	Parent report that they are unable to afford needed asthma medications establishes that the ED was an appropriate level of care for that child.	1	1	5	0	1	1	0	0	0	3	0.9
2.40	Parent report that they are unable to obtain needed care because of financial barriers establishes that the ED was an appropriate level of care for that child.	1	0	5	0	1	1	0	0	1	3	1.4
2.41	Parent report that they are unable to obtain needed care because of barriers other than financial establishes that the ED was an appropriate level of care for that child.	1	0	4	1	2	0	1	0	0	3	1.2
2.42	Triage nurse reports can be used to determine that the ED is an appropriate level of care.	0	0	1	1	1	1	3	1	1	7	1.4

		1	2	3	4	5	6	7	8	9		
2.43	Triage nurse reports can be used to determine that the ED is not an appropriate level of care.	1	0	0	2	1	0	3	2	0	7	1.8
2.44	Parent report that the child was in a green zone indicates that the ED is not an appropriate level of care.	1	0	0	0	1	0	3	3	1	7	1.4
2.45	Parent report that the child was in a yellow zone indicates that the ED is not an appropriate level of care.	0	0	5	0	2	1	0	1	0	3	1.3
2.46	Parent report that the child was in a yellow zone indicates that the ED is an appropriate level of care.	0	1	0	1	3	1	3	0	0	5	1.2
2.47	Parent report that the child was in a red zone indicates that the ED is an appropriate level of care.	0	0	0	0	1	0	1	3	4	8	0.9
2.49	Parent report that the child is on usual controller meds and flunked controller meds suggests the ED is an appropriate level of care.	0	3	0	0	2	2	2	0	0	5	1.7

Chapter 3

#	Scenario	Frequency									Median	Variation
		1	2	3	4	5	6	7	8	9		
3.01	Parent report that their child's asthma is well managed establishes that the child's asthma was well managed.	1	2	0	0	2	1	3	0	0	5	1.9
		1	2	3	4	5	6	7	8	9		
3.02	Parent report that their child's asthma is not well managed establishes that the child's asthma was not well managed.	0	0	0	1	1	3	1	1	2	6	1.3
		1	2	3	4	5	6	7	8	9		
3.03	Referral to a multidisciplinary (non MD) asthma care provider is characteristic of well managed asthma.	0	1	0	2	3	1	2	0	0	5	1.1
		1	2	3	4	5	6	7	8	9		
3.04	Referral to an MD asthma specialist is characteristic of well managed asthma.	0	1	2	1	1	1	0	2	1	5	2.1
		1	2	3	4	5	6	7	8	9		
3.05	Ongoing primary care is characteristic of well managed asthma	0	0	0	2	0	1	2	0	4	7	1.7
		1	2	3	4	5	6	7	8	9		
3.06	Existence of an asthma action plan is characteristic of well managed asthma.	0	0	0	0	0	4	3	1	1	7	0.8
		1	2	3	4	5	6	7	8	9		
3.07	Parent report that they have a written asthma action plan is characteristic of well managed asthma.	0	0	0	0	2	1	3	3	0	7	0.9
		1	2	3	4	5	6	7	8	9		
3.08	Parent report that they understand how to implement their child's asthma action plan is characteristic of well managed asthma.	0	0	0	0	0	2	0	4	3	8	0.8
		1	2	3	4	5	6	7	8	9		
3.09	Ongoing adherence to an asthma maintenance/prevention schedule is characteristic of well managed asthma.	0	0	0	0	0	1	1	3	4	8	0.8

		1	2	3	4	5	6	7	8	9		
3.10	Prescription of maintenance medication(s) is characteristic of well managed asthma.	0	0	2	0	2	0	4	0	1	7	1.6
		1	2	3	4	5	6	7	8	9		
3.11	Ongoing and regularly filled prescriptions for maintenance medications is characteristic of well managed asthma.	0	0	0	0	0	1	1	4	3	8	0.7
		1	2	3	4	5	6	7	8	9		
3.12	Availability of rescue medications is characteristic of well managed asthma	0	0	0	1	0	0	3	1	4	8	1.2
		1	2	3	4	5	6	7	8	9		
3.13	Having a peak flow meter is characteristic of well managed asthma.	0	0	2	0	3	0	2	1	1	5	1.7
		1	2	3	4	5	6	7	8	9		
3.14	Assessment of PFV prior to the ED visit is characteristic of well managed asthma.	1	0	2	0	0	1	2	2	1	7	2.1
		1	2	3	4	5	6	7	8	9		
3.15	Therapeutic trial of asthma rescue medication immediately prior to the ED visit is characteristic of well managed asthma.	0	0	0	1	0	2	3	2	1	7	1.0
		1	2	3	4	5	6	7	8	9		
3.16	An ongoing relationship with an identifiable primary clinical for their child's asthma is characteristic of well managed asthma.	0	0	0	0	1	0	1	3	4	8	0.9
		1	2	3	4	5	6	7	8	9		
3.17	Maintaining a written log of peak flow is characteristic of well managed asthma.	0	0	0	0	3	0	1	3	2	8	1.3
		1	2	3	4	5	6	7	8	9		
3.18	An identified site for regular care is characteristic of well managed asthma.	0	0	0	0	0	3	1	2	3	8	1.1
		1	2	3	4	5	6	7	8	9		
3.19	Access to a primary clinician when urgent care is needed is characteristic of well managed asthma.	0	0	0	0	1	1	2	2	3	8	1.1

		1	2	3	4	5	6	7	8	9		
3.20	Regular primary care visits are characteristic of well managed asthma	0	0	0	0	1	1	1	3	3	8	1.0
3.21	Parent awareness of general triggers is characteristic of well managed asthma	0	0	0	0	1	0	4	1	3	7	1.0
3.22	Parent awareness of triggers specific to their child is characteristic of well managed asthma	0	0	0	0	0	0	2	2	5	9	0.7
3.23	Reducing environmental triggers in the home is characteristic of well managed asthma	0	0	0	0	0	0	2	3	4	8	0.7
3.24	Having had a primary care or asthma specialist visit within 1 month of the ED visit is evidence of well managed asthma	0	0	3	0	1	0	2	1	2	7	2.1
3.25	Having had a primary care or asthma specialist visit within 2 months of the ED visit is evidence of well managed asthma	0	0	3	0	1	0	2	2	1	7	2.0
3.26	Having had a primary care or asthma specialist visit within 3 months of the ED visit is evidence of well managed asthma	0	0	3	0	1	0	3	1	1	7	1.9
3.27	Having had a primary care or asthma specialist visit within 4 months of the ED visit is evidence of well managed asthma	0	0	3	0	1	1	3	1	0	6	1.7
3.28	Having had a primary care or asthma specialist visit within 6 months of the ED visit is evidence of well managed asthma	1	0	2	0	2	2	1	1	0	5	1.7
3.29	Having had a primary care or asthma specialist visit within 12 months of the ED visit is evidence of well managed asthma	1	2	2	1	2	1	0	0	0	3	1.3

		1	2	3	4	5	6	7	8	9		
3.30	Not having had a primary care or asthma specialist visit within 1 month of the ED visit suggests that the asthma was not well managed.	1	3	3	0	0	1	0	1	0	3	1.4
3.31	Not having had a primary care or asthma specialist visit within 2 months of the ED visit suggests that the asthma was not well managed.	1	3	3	0	0	0	1	1	0	3	1.6
3.32	Not having had a primary care or asthma specialist visit within 3 months of the ED visit suggests that the asthma was not well managed.	1	2	3	0	0	0	2	1	0	3	1.9
3.33	Not having had a primary care or asthma specialist visit within 4 months of the ED visit suggests that the asthma was not well managed.	1	2	2	0	0	1	1	2	0	3	2.3
3.34	Not having had a primary care or asthma specialist visit within 6 months of the ED visit suggests that the asthma was not well managed.	1	1	0	0	0	1	2	2	2	7	2.0
3.35	Not having had a primary care or asthma specialist visit within 12 months of the ED visit suggests that the asthma was not well managed.	1	0	0	0	0	1	2	2	3	8	1.6
3.36	Parent understanding of asthma is characteristic of well managed asthma	0	0	0	0	0	0	2	1	6	9	0.6
3.37	A home visit to explore or remediate asthma triggers is characteristic of well managed asthma.	0	0	2	0	2	0	2	1	2	7	1.9
3.38	Prescription of controller medications is indicative of well managed asthma.	0	0	1	1	1	1	4	1	0	7	1.2
3.39	Regular use of controller medications is indicative of well managed asthma	0	0	0	0	1	1	2	3	2	8	1.0

		1	2	3	4	5	6	7	8	9		
3.40	Understanding use of rescue medications is characteristic of well managed asthma.	0	0	0	0	0	1	2	2	4	8	0.9
3.41	If a child's asthma is well managed, the parent of that child in the ED should be able to report whether the child is in a red, yellow, or green zone.	0	0	0	0	0	1	2	3	3	8	0.8
3.42	If a child's asthma is well managed, the parent of that child in the ED should be able to explain why the child is in a red, yellow, or green zone.	0	0	0	0	0	1	2	3	3	8	0.8
3.43	Smoking in the home is evidence of poor asthma management	1	0	1	0	2	0	2	1	2	7	2.1
3.44	Parent report that they have not been advised not to smoke in the home is evidence of poor clinical asthma management.	0	0	0	1	1	0	0	1	6	9	1.1
3.45	Dogs in the home are evidence of poor asthma management.	2	2	1	0	2	0	2	0	0	3	2.0
3.46	Parent report that they have not been advised about the risks of dogs in the home is evidence of poor clinical asthma management.	1	2	0	0	1	2	1	0	2	6	2.3
3.47	Cats in the home are evidence of poor asthma management.	1	1	1	1	1	1	3	0	0	5	1.9
3.48	Parent report that they have not been advised about the risks of cats in the home is evidence of poor clinical asthma management.	1	1	0	1	0	0	2	2	2	7	2.2
3.49	Parent report of regular (weekly or more) use of rescue medications implies the need for regular use of controller medications.	0	0	0	0	0	0	3	3	3	8	0.7

		1	2	3	4	5	6	7	8	9		
3.50	Evaluation for respiratory allergies is an important component of well managed asthma.	0	0	0	0	1	0	2	3	3	8	0.9
3.51	24/7 Access to a primary or coverage clinician is necessary for appropriate asthma care.	0	1	0	0	0	0	2	2	4	8	1.3
3.52	After hours office care is an important component of well managed asthma.	0	0	1	0	0	0	3	3	2	8	1.1
3.53	Urgent phone access to a primary clinician during day time hours is an important component of well managed asthma.	0	0	0	0	0	0	3	3	3	8	0.7
3.54	Urgent phone access to a primary clinician after hours is an important component of well managed asthma.	0	0	1	0	0	1	2	3	2	8	1.2
3.55	A primary clinician who knows the child is an important component of well managed asthma.	0	0	1	0	0	1	2	1	4	8	1.4
3.56	A clinician who the parent can understand is an important component of well managed asthma.	0	0	0	0	0	0	2	3	4	8	0.7
3.57	A clinician who can manage a child with an early asthma exacerbation urgently in their office is an important component of well managed asthma.	0	0	0	0	0	1	1	3	4	8	0.8
3.58	A clinician that assesses peak flow as a routine component of asthma care is an important component of well managed asthma.	1	0	1	1	1	0	4	1	0	7	1.8
3.59	The ability to manage acute visits in a timely fashion in the office is an essential part of asthma care.	0	0	0	0	0	0	1	2	6	9	0.4

Chapter 4

#	Scenario	Frequency									Median	Variation
		1	2	3	4	5	6	7	8	9		
4.01	Parent report of financial inability to obtain medications suggests a family origin of the ED visit.	0	0	0	1	0	1	5	0	2	7	0.9
		1	2	3	4	5	6	7	8	9		
4.02	Parent report of financial inability to obtain medications suggests a system origin of the ED visit.	0	1	0	0	0	0	5	1	2	7	1.1
		1	2	3	4	5	6	7	8	9		
4.03	Running out of a controller medication for other than financial reasons suggests a family origin for the ED visit	0	0	0	0	0	0	3	3	3	8	0.7
		1	2	3	4	5	6	7	8	9		
4.04	Running out of a rescue medication for other than financial reasons suggests a family origin for the ED visit.	0	0	0	0	0	0	2	4	3	8	0.6
		1	2	3	4	5	6	7	8	9		
4.05	Smoking in the home suggests a family origin for an exacerbation.	0	0	0	0	1	0	3	3	2	8	0.9
		1	2	3	4	5	6	7	8	9		
4.06	Failure to do environmental assessment of the home suggests a family origin to an exacerbation.	1	1	2	1	1	3	0	0	0	4	1.6
		1	2	3	4	5	6	7	8	9		
4.07	Failure to do environmental assessment of the home suggests a system origin to an exacerbation.	1	1	0	0	0	2	4	1	0	7	1.6
		1	2	3	4	5	6	7	8	9		
4.08	Failure to do environmental remediation of the home suggests a family origin to an exacerbation.	1	1	0	1	0	3	1	1	1	6	1.9
		1	2	3	4	5	6	7	8	9		
4.09	Failure to do environmental remediation of the home suggests a system origin to an exacerbation.	1	1	2	0	1	1	2	1	0	5	2.1
		1	2	3	4	5	6	7	8	9		
4.10	Lack of understanding of asthma triggers suggests a family origin to an ED visit.	0	1	1	0	2	2	2	1	0	6	1.4

		1	2	3	4	5	6	7	8	9		
4.11	Lack of understanding of asthma triggers suggests a system origin to an ED visit.	0	0	0	0	2	0	3	4	0	7	0.9
4.12	Parent report of inability to reach a primary clinician by phone suggests a system origin to an ED visit.	0	0	0	0	0	1	4	4	0	7	0.6
4.13	Parent report of not having a phone number to call a primary physician suggests a system origin to an ED visit.	0	0	1	0	2	1	2	3	0	7	1.3
4.14	Parent report of not having a primary care physician suggests a system origin to an ED visit.	0	0	1	1	0	1	3	2	1	7	1.3
4.15	Parent report that they feel more comfortable with an asthma exacerbation in the ED than in the primary care office suggests a family origin to the ED visit.	0	1	0	0	3	1	4	0	0	6	1.2
4.16	Parent report that they feel more comfortable with an asthma exacerbation in the ED than in the primary care office suggests a system origin to the ED visit.	0	0	1	0	1	2	3	2	0	7	1.1
4.17	Parent report that they were directed to the ED by the primary clinician's office suggests a system origin for the ED visit.	0	0	2	0	0	0	0	7	0	8	1.1
4.18	Parent report that they often see different clinicians at their primary source of care suggests a system origin for the ED visit.	0	0	2	1	1	1	4	0	0	6	1.4
4.19	Parent report that they don't know well the clinician who they would see at their primary source of care suggests a system origin for the ED visit.	0	0	3	1	1	1	2	1	0	5	1.7

		1	2	3	4	5	6	7	8	9		
4.20	Parent report that the clinician who would see them at their primary source of care don't know them or their child well suggests a system origin for the ED visit.	0	0	2	2	1	0	3	1	0	5	1.7
4.21	Parent report of referral to non-physician asthma provider (eg nurse specialist, social worker) or multidisciplinary care suggests a patient origin for the asthma visit.	1	2	1	0	3	1	0	1	0	5	1.8
4.22	Parent report that there was not a referral to non-physician asthma provider (eg nurse specialist, social worker) or multidisciplinary care suggests a system origin for the asthma visit.	2	0	2	0	4	1	0	0	0	5	1.4
4.23	Parent report that they failed to adhere to advice that they understood regarding the management of asthma suggests a family origin for the ED visit.	0	0	0	0	1	0	2	2	4	8	1.0
4.24	Parent report that they did not understand what asthma is suggests a system origin for the ED visit.	0	0	0	0	1	1	4	3	0	7	0.7
4.25	Parent report that they have a hard time understanding what their clinician tells them regarding asthma suggest a system origin for the ED visit.	0	0	0	0	1	1	3	3	1	7	0.9
4.26	Parent report that they have a written asthma plan that they do not understand/know how to use suggests a system origin for the ED visit.	0	0	0	0	2	2	2	3	0	7	1.0
4.27	Parent report that they do not have a written asthma plan suggests a system origin for the ED visit.	0	0	0	0	1	1	2	4	1	8	0.9

		1	2	3	4	5	6	7	8	9		
4.28	Parent report of a previous bad experience in managing acute asthma at the clinician's office suggests a system origin for the ED visit.	0	0	0	0	1	1	4	3	0	7	0.7
		1	2	3	4	5	6	7	8	9		
4.29	Parent report that they trust the ED more than their clinician to manage asthma suggests a system origin for the asthma visit.	0	0	0	0	2	0	3	4	0	7	0.9
		1	2	3	4	5	6	7	8	9		
4.30	Parent report that they have not followed their clinician's advice regarding asthma management suggest a family origin for the ED visit.	0	0	0	0	2	1	3	1	2	7	1.1
		1	2	3	4	5	6	7	8	9		
4.31	Parent report that they do not understand how to assess an exacerbation suggests a family origin for the ED visit.	0	0	1	1	4	2	1	0	0	5	0.8
		1	2	3	4	5	6	7	8	9		
4.32	Parent report that they do not understand how to assess an exacerbation suggests a system origin for the ED visit.	0	0	0	1	3	1	4	0	0	6	1.0
		1	2	3	4	5	6	7	8	9		
4.33	Parent report that they do not understand what may trigger their child's asthma suggests a family origin for the ED visit.	0	0	2	0	3	2	2	0	0	5	1.1
		1	2	3	4	5	6	7	8	9		
4.34	Parent report that they do not understand what may trigger their child's asthma suggests a system origin for the ED visit.	0	0	1	0	3	1	2	2	0	6	1.3

Chapter 5

#	Scenario	Frequency									Median	Variation
		1	2	3	4	5	6	7	8	9		
5.01	Door to nurse time is a valuable measure of the Quality of the ED visit for a child with asthma	1	0	1	0	2	0	1	3	1	7	2.1
		1	2	3	4	5	6	7	8	9		
5.02	Door to nurse time for a child with asthma should be less than 5 minutes.	1	1	0	0	1	1	1	1	3	7	2.3
		1	2	3	4	5	6	7	8	9		
5.03	Door to nurse time for a child with asthma should be less than 15 minutes.	1	0	1	0	0	0	2	2	3	8	1.9
		1	2	3	4	5	6	7	8	9		
5.04	Door to nurse time for a child with asthma should be less than 30 minutes.	1	0	0	1	1	0	0	1	5	9	2.0
		1	2	3	4	5	6	7	8	9		
5.05	Door to nurse time for a child with asthma should be less than 45 minutes.	1	0	1	0	0	0	1	0	6	9	1.8
		1	2	3	4	5	6	7	8	9		
5.06	Door to doctor/clinician time is a valuable measure of the Quality of the ED visit for a child with asthma	0	0	0	2	1	0	1	3	2	8	1.6
		1	2	3	4	5	6	7	8	9		
5.07	Door to doctor/clinician time for a child with asthma should be less than 5 minutes.	1	2	2	0	2	0	1	0	1	3	2.0
		1	2	3	4	5	6	7	8	9		
5.08	Door to doctor/clinician time for a child with asthma should be less than 15 minutes.	0	1	1	1	2	1	1	0	2	5	1.9
		1	2	3	4	5	6	7	8	9		
5.09	Door to doctor/clinician time for a child with asthma should be less than 30 minutes.	0	1	0	0	3	0	1	1	3	7	2.0
		1	2	3	4	5	6	7	8	9		
5.10	Door to doctor/clinician time for a child with asthma should be less than 45 minutes.	0	0	0	0	1	1	2	1	4	8	1.2

		1	2	3	4	5	6	7	8	9		
5.11	Door to doctor/clinician time for a child with asthma should be less than 60 minutes.	0	0	0	0	1	0	1	1	6	9	0.8
5.12	Documenting a recognized asthma severity score should occur in all ED visits for children with asthma	1	0	1	0	0	0	2	1	4	8	2.0
5.13	Documenting a recognized asthma severity score should occur within 15 minutes of arrival to the ED.	1	0	2	0	1	0	1	1	3	7	2.6
5.14	Documenting a recognized asthma severity score should occur within 30 minutes of arrival to the ED.	1	0	1	0	1	0	0	3	3	8	2.0
5.15	Documenting a recognized asthma severity score should occur within 45 minutes of arrival to the ED.	1	0	1	0	0	0	1	0	6	9	1.8
5.16	Documenting a recognized asthma severity score should occur within 60 minutes of arrival to the ED.	1	0	1	0	0	0	0	1	6	9	1.7
5.17	Documenting an oxygen saturation level should occur in all ED visits for children with asthma	1	0	1	0	0	0	1	1	5	9	1.9
5.18	Documenting an oxygen saturation level should occur within 15 minutes of arrival to the ED.	0	0	1	0	1	1	1	1	4	8	1.7
5.19	Documenting an oxygen saturation level should occur within 30 minutes of arrival to the ED.	0	0	0	0	0	2	0	3	4	8	0.9
5.20	Documenting an oxygen saturation level should occur within 45 minutes of arrival to the ED.	0	0	0	0	0	0	0	2	7	9	0.2
5.21	Documenting an oxygen saturation level should occur within 60 minutes of arrival to the ED.	0	0	0	0	0	0	0	0	9	9	0.0

		1	2	3	4	5	6	7	8	9		
5.23	Arranging for post discharge outpatient care is an essential component of the ED visit for children with asthma.	0	0	0	0	1	1	0	1	6	9	0.9
5.24	It is important for ambulatory follow up to be with a facility that can provide or coordinate ongoing care.	0	0	0	0	0	0	1	3	5	9	0.6
5.25	Children with asthma discharged after an ED visit should be seen within one day of discharge.	2	0	2	0	3	0	0	2	0	5	2.0
5.26	Children with asthma discharged after an ED visit should be seen within two days of discharge.	1	0	2	0	2	1	0	1	2	5	2.2
5.27	Children with asthma discharged after an ED visit should be seen within three days of discharge.	1	0	1	1	1	0	2	1	2	7	2.2
5.28	Children with asthma discharged after an ED visit should be seen within five days of discharge.	0	0	1	0	1	1	2	1	3	7	1.6
5.29	Children with asthma discharged after an ED visit should be seen within one week of discharge.	0	0	0	0	1	2	2	1	3	7	1.2
5.30	Children with asthma discharged after an ED visit should be seen within two weeks of discharge.	0	0	0	0	1	1	1	2	4	8	1.1
5.31	Children with asthma discharged after an ED visit should be seen within three weeks of discharge.	0	0	0	0	2	0	1	1	5	9	1.2
5.32	Children with asthma discharged after an ED visit should be seen within four weeks of discharge.	0	0	0	0	2	0	0	2	5	9	1.1
5.33	Children with asthma discharged after an ED visit should be seen within one month of discharge.	0	0	0	0	2	0	0	2	5	9	1.1

		1	2	3	4	5	6	7	8	9		
5.34	Children with asthma discharged after an ED visit should be seen within three months of discharge.	0	0	0	0	2	0	0	0	7	9	0.9
5.35	An identified primary clinician or office should be identified (or the lack of such a clinician should be documented at the time of the ED visit.	0	0	0	0	0	0	0	2	7	9	0.2
5.36	The identified primary clinician (if exists) or their office should be contacted during the ED visit.	1	1	1	0	2	1	0	1	2	5	2.3
5.37	The identified primary clinician (if exists) or their office should be contacted within 24 hours of the ED visit.	0	0	1	0	0	0	1	2	5	9	1.1
5.38	The identified primary clinician (if exists) or their office should be contacted within 48 hours of the ED visit.	0	0	1	0	0	0	1	2	5	9	1.1
5.39	The identified primary clinician (if exists) or their office should be contacted within 72 hours of the ED visit.	0	0	1	0	0	1	0	0	7	9	1.0
5.40	No more than 5 minutes should elapse between the time that a parenteral anti-asthma medication is ordered for children with asthma and receipt of the medication	1	1	2	0	1	0	3	1	0	5	2.2
5.41	No more than 10 minutes should elapse between the time that a parenteral anti-asthma medication is ordered for children with asthma and receipt of the medication	1	1	1	0	2	0	0	1	3	5	2.7

		1	2	3	4	5	6	7	8	9		
5.42	No more than 15 minutes should elapse between the time that a parenteral anti-asthma medication is ordered for children with asthma and receipt of the medication	0	0	0	0	2	1	2	0	4	7	1.4
5.43	No more than 20 minutes should elapse between the time that a parenteral anti-asthma medication is ordered for children with asthma and receipt of the medication	0	0	0	0	1	0	2	1	5	9	1.0
5.44	No more than 30 minutes should elapse between the time that a parenteral anti-asthma medication is ordered for children with asthma and receipt of the medication	0	1	0	0	1	0	0	1	6	9	1.3
5.45	No more than 45 minutes should elapse between the time that a parenteral anti-asthma medication is ordered for children with asthma and receipt of the medication	1	0	0	0	1	0	0	0	7	9	1.3
5.46	No more than 60 minutes should elapse between the time that a parenteral anti-asthma medication is ordered for children with asthma and receipt of the medication	2	0	0	0	1	0	0	0	6	9	2.2
5.47	No more than 5 minutes should elapse between the time that a parenteral anti-asthma medication is ordered for children with asthma and receipt of the medication	1	1	2	0	1	0	3	1	0	5	2.2
5.48	Door to nurse time is a valuable measure of the Quality of the ED visit for a child presenting with moderate to severe asthma.	1	0	0	0	0	1	1	3	3	8	1.4
5.49	Door to nurse time for a child with asthma should be less than 5 minutes for a child presenting with moderate to severe asthma.	1	0	0	0	0	0	2	3	3	8	1.3

		1	2	3	4	5	6	7	8	9		
5.50	Door to nurse time for a child with asthma should be less than 15 minutes for a child presenting with moderate to severe asthma.	1	0	0	0	0	0	0	1	7	9	1.0
5.51	Door to nurse time for a child with asthma should be less than 30 minutes for a child presenting with moderate to severe asthma.	1	0	0	0	0	0	0	0	8	9	0.9
5.52	Door to nurse time for a child with asthma should be less than 45 minutes for a child presenting with moderate to severe asthma.	1	0	0	0	0	0	0	0	8	9	0.9
5.53	Door to doctor/clinician time is a valuable measure of the Quality of the ED visit for a child presenting with moderate to severe asthma.	0	0	0	0	0	0	1	5	3	8	0.4
5.54	Door to doctor/clinician time for a child with asthma should be less than 5 minutes for a child presenting with moderate to severe asthma.	0	0	2	0	2	2	2	1	0	6	1.3
5.54	Door to doctor/clinician time for a child with asthma should be less than 15 minutes for a child presenting with moderate to severe asthma.	0	0	0	0	0	0	4	0	5	9	0.9
5.55	Door to doctor/clinician time for a child with asthma should be less than 30 minutes for a child presenting with moderate to severe asthma.	0	0	0	0	0	0	0	1	8	9	0.1
5.56	Door to doctor/clinician time for a child with asthma should be less than 45 minutes for a child presenting with moderate to severe asthma.	0	0	0	0	0	0	0	0	9	9	0.0

		1	2	3	4	5	6	7	8	9		
5.57	Door to doctor/clinician time for a child with asthma should be less than 60 minutes for a child presenting with moderate to severe asthma.	0	0	0	0	0	0	0	0	9	9	0.0
		1	2	3	4	5	6	7	8	9		
5.58	Documenting an oxygen saturation level should occur in all ED visits for a child presenting with moderate to severe asthma.	0	0	0	0	0	0	0	0	9	9	0.0
		1	2	3	4	5	6	7	8	9		
5.59	Documenting an oxygen saturation level should occur within 15 minutes of arrival to the ED for a child presenting with moderate to severe asthma.	0	0	0	0	0	0	2	1	6	9	0.6
		1	2	3	4	5	6	7	8	9		
5.60	Documenting an oxygen saturation level should occur within 30 minutes of arrival to the ED for a child presenting with moderate to severe asthma.	0	0	0	0	0	0	0	0	9	9	0.0
		1	2	3	4	5	6	7	8	9		
5.61	Documenting an oxygen saturation level should occur within 45 minutes of arrival to the ED for a child presenting with moderate to severe asthma.	0	0	0	0	0	0	0	0	9	9	0.0
		1	2	3	4	5	6	7	8	9		
5.62	Documenting an oxygen saturation level should occur within 60 minutes of arrival to the ED for a child presenting with moderate to severe asthma.	0	0	0	0	0	0	0	0	9	9	0.0

Appendix E

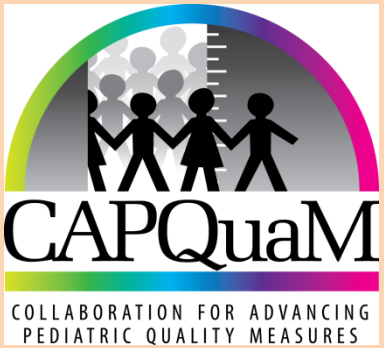
Pediatric Academic Society

State of the Science Presentation

May 2012 (given by Dr. Larry Kleinman)

Applying Evidence Standards in an Uncertain World

Considering uncertainty when developing measures in the PQMP



Lawrence C. Kleinman, MD, MPH, FAAP
PI, Mount Sinai CAPQuaM
PAS State of the Science
May, 2012

AHRQ-CMS CHIPRA C o E, Funded by AHRQ 1 U18 HS020518-01

Rock n Roll

http://www.youtube.com/watch?feature=player_detailpage&v=QXgMhnI3QOI#t=71s

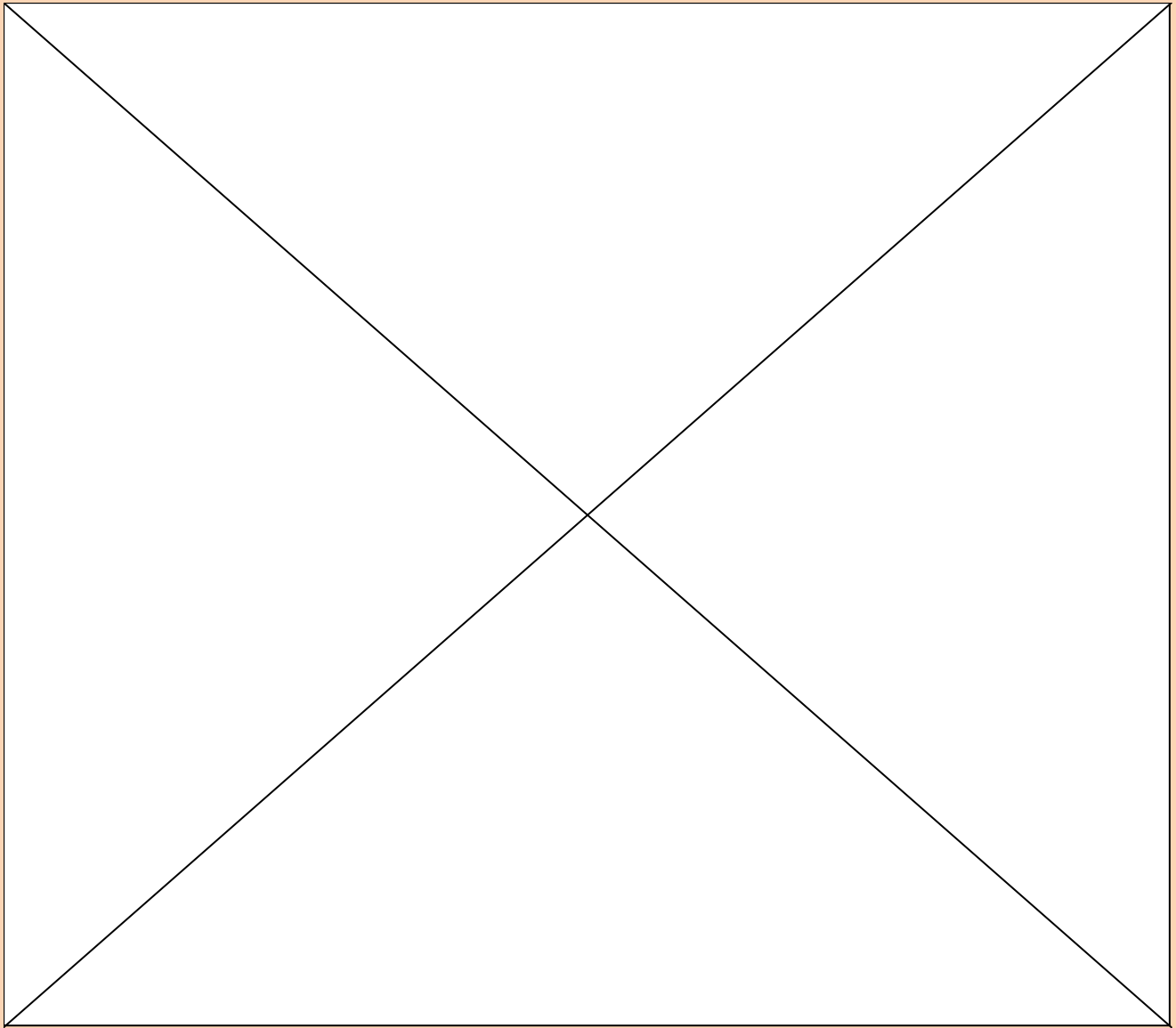
This ain’t no Party, this ain’t no Disco,
This ain’t no fooling around;
No time for Dancing, or Lovey Dovey,
I ain’t got time for that now
Transmit the message to the receiver;
Hope for an answer some day...

Sources of uncertainty abound...

- The science is constantly evolving;
- Evidence in the literature is challenging to apply to a specific patient:
  - e.g., Inclusion and exclusion criteria limit generalizability of trials
- Real world outcomes vary from research trial outcomes.
- Science reduces uncertainty, doesn't eliminate it

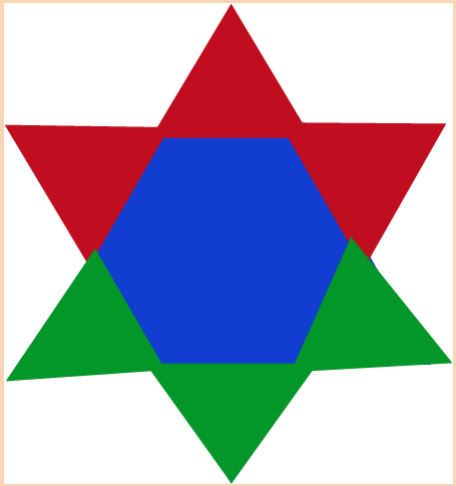
The Challenge of Evidence

http://www.youtube.com/watch?v=Dn1eT55sD6o&feature=player_embedded

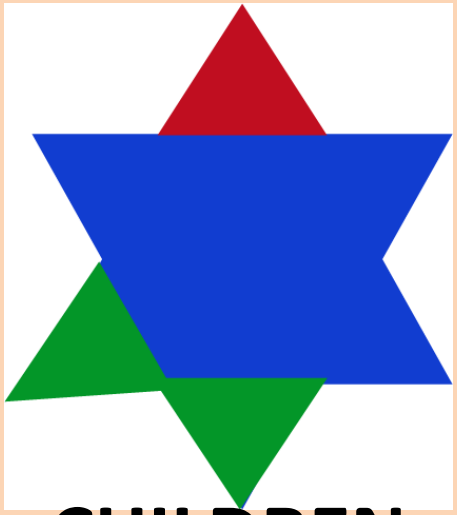


Uncertainty Index (UNI)

- Proportion of **care** that has not been shown to be **ineffective** and that we aren't sure is **effective**
- Children's health care is under researched compared to adults and thus ↑ UNI
  - In general ↓Research→ ↑ UNI



ADULTS

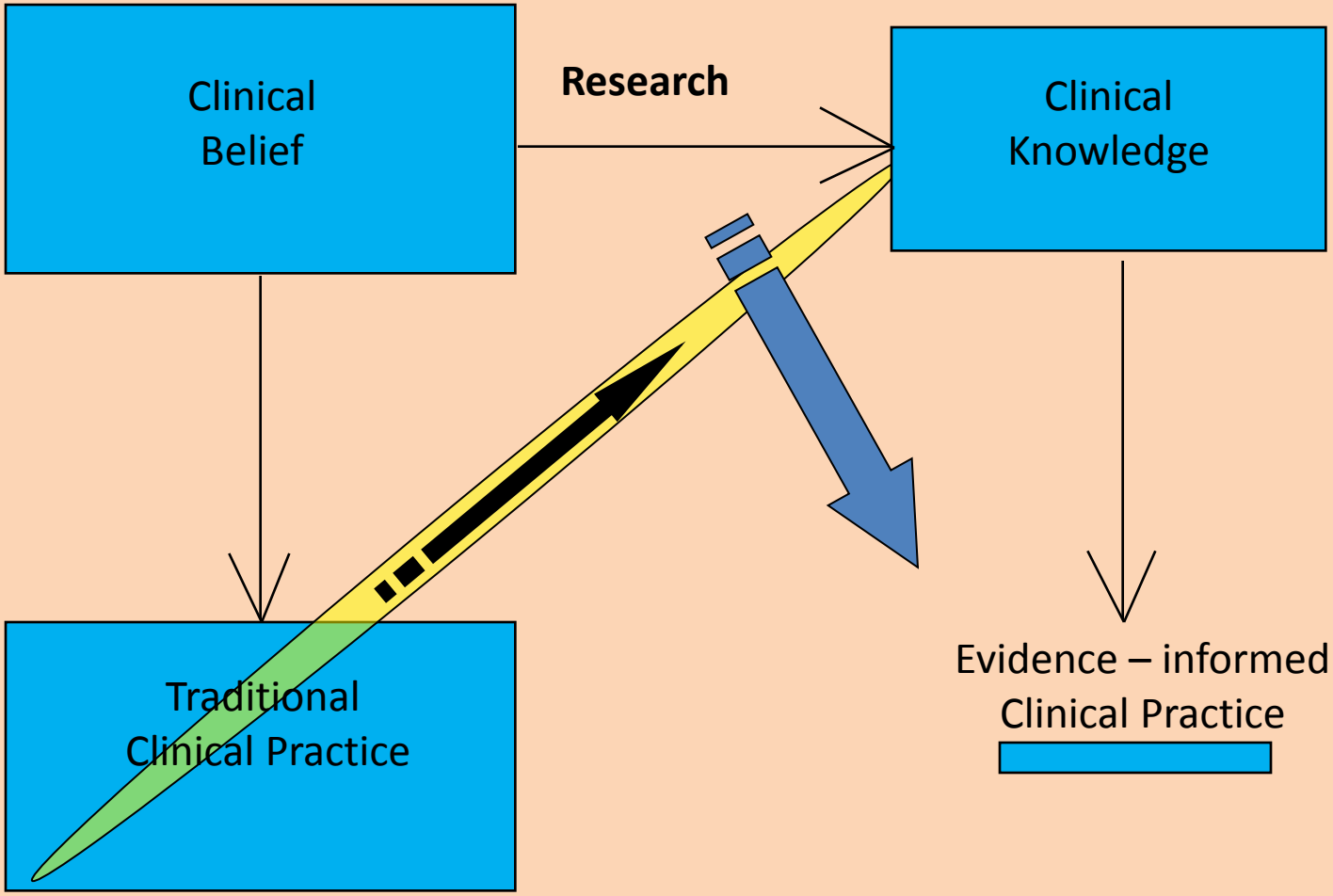


CHILDREN

$$\text{UNI} = \frac{\text{Blue}}{\text{Blue} + \text{Green}}$$

Kleinman LC, Am J Prev Med, 1998

Evidence is particularly limited when it comes to pediatric care



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COLLABORATION FOR ADVANCING PEDIATRIC QUALITY MEASURES

We are looking for measures that represent the keys to high quality care

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One need for PQMP Innovation

- Develop and enhance methods that can produce meaningful measures even when the science does not reduce uncertainty enough to eliminate all important disagreements

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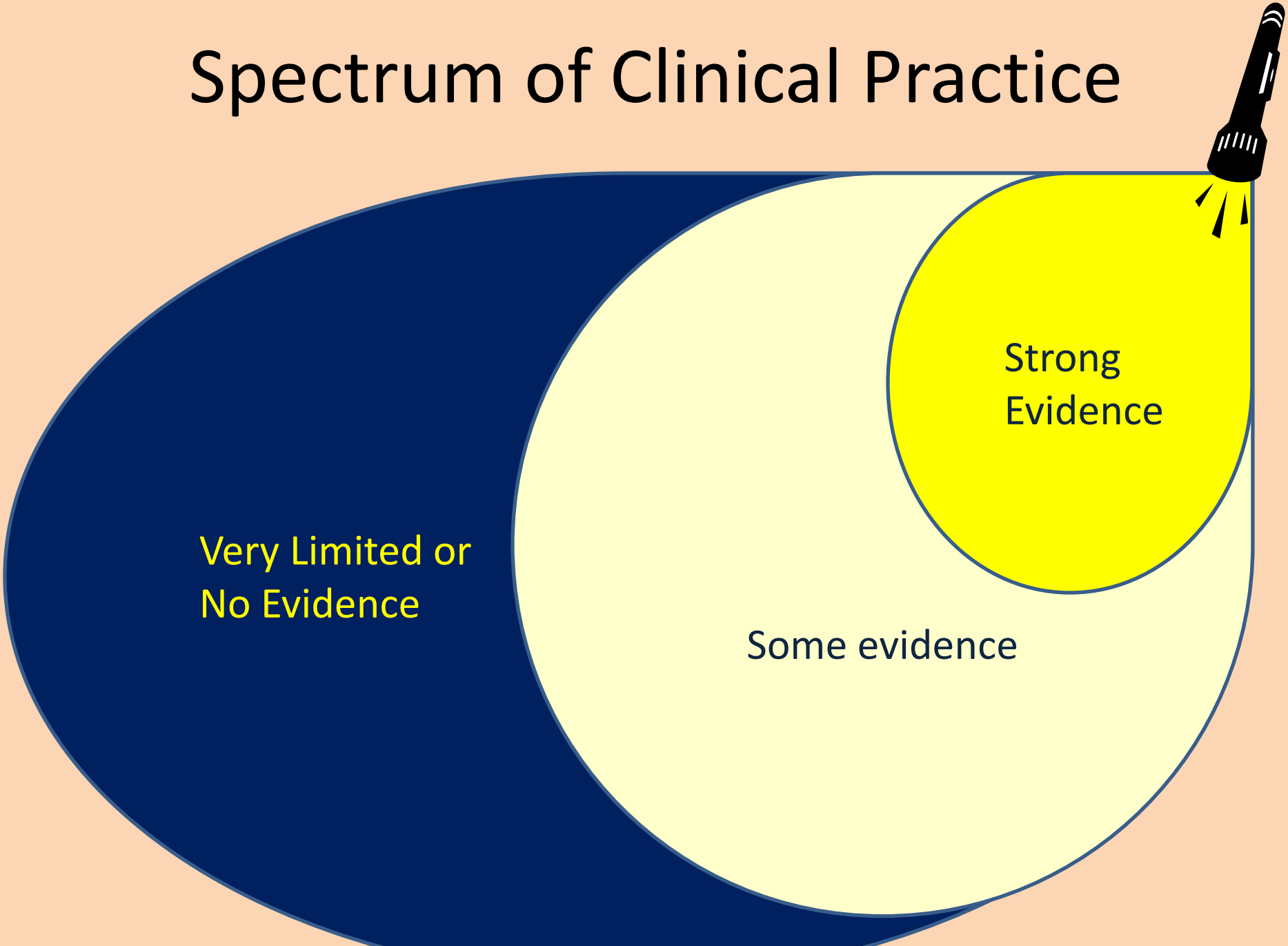
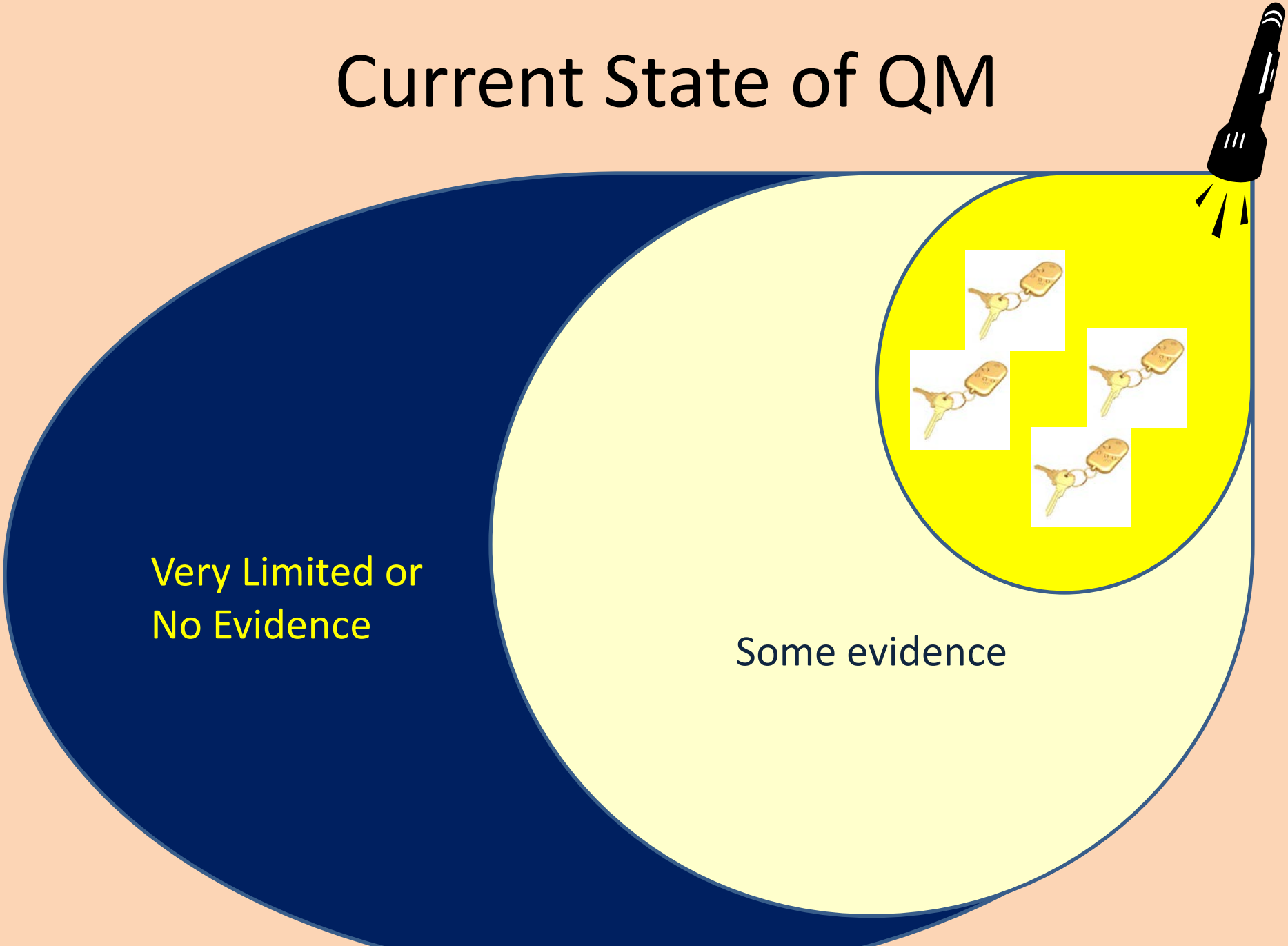
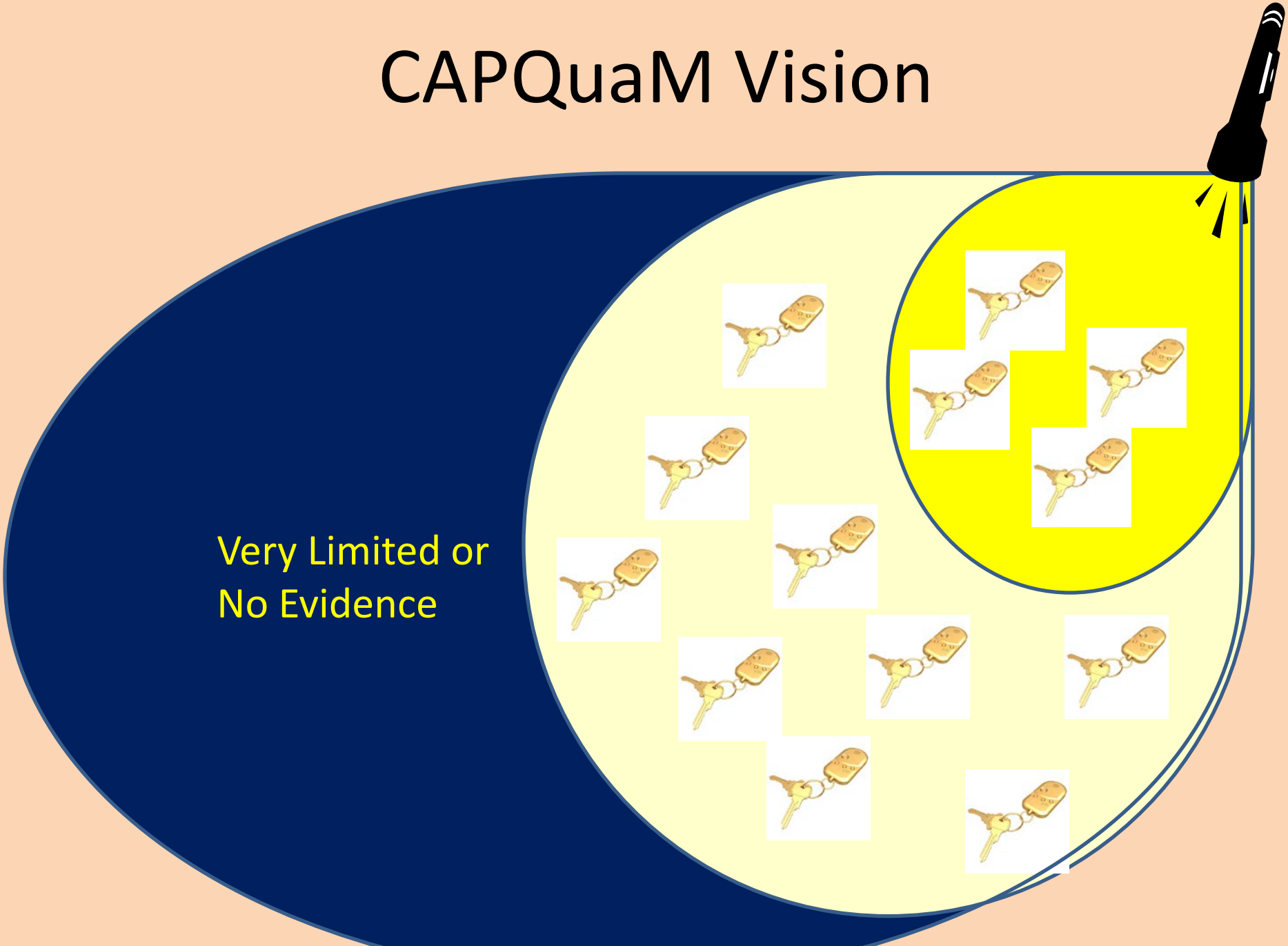
Spectrum of Clinical Practice



Current State of QM



CAPQuaM Vision



Definition: High Risk Obstetrical Services

How do we identify the target population?

- By conditions present in the woman?
- By clinical services required?
- By the clinicians providing the services?

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Definition: Availability*

- Geographic: Density and Distance
  - Accepts Medicaid?
- Timeliness:
  - Delays for appointments?
- Process availability
  - Barriers to care?

*(AHRQ commissioned paper: Kuhlthau; 2010)

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Construct of Availability

- Derived from Aday, Andersen, et al, 1974
- Availability necessary for accessibility
- Often necessary to measure availability indirectly by measuring access

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CHIPRA Availability Measure

- Measure should capture impact of health care system on availability
- Differences in access reflect both system and individual contributions
- CHIPRA measure should capture differences across health care systems that reflect system contributions/differences

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What is Availability

- System's contribution to *potential* access*
- Contrast to utilization, which is a measure of *realized* access
  - Both system and individual contributions
- High levels of utilization are evidence of availability
- Underutilization (or over-utilization of rescue services) may indicate care not available

*Andersen RM, et al 1974
Aday & Andersen, 1983

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Measuring Availability

- Lack of availability may be measured directly or indirectly
- Sufficient availability typically measured indirectly through access/utilization measures

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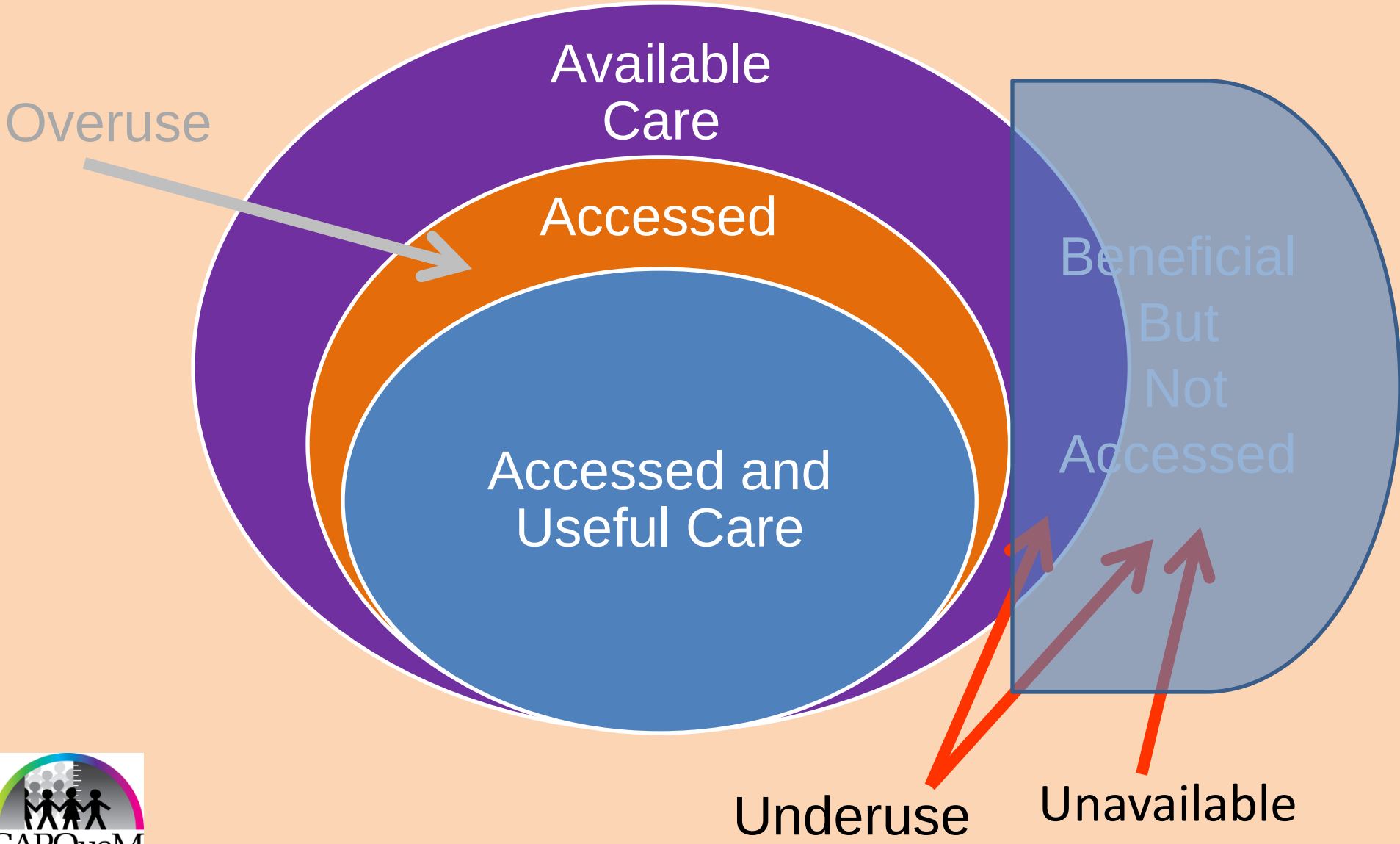
Measure: Availability of HROB Care



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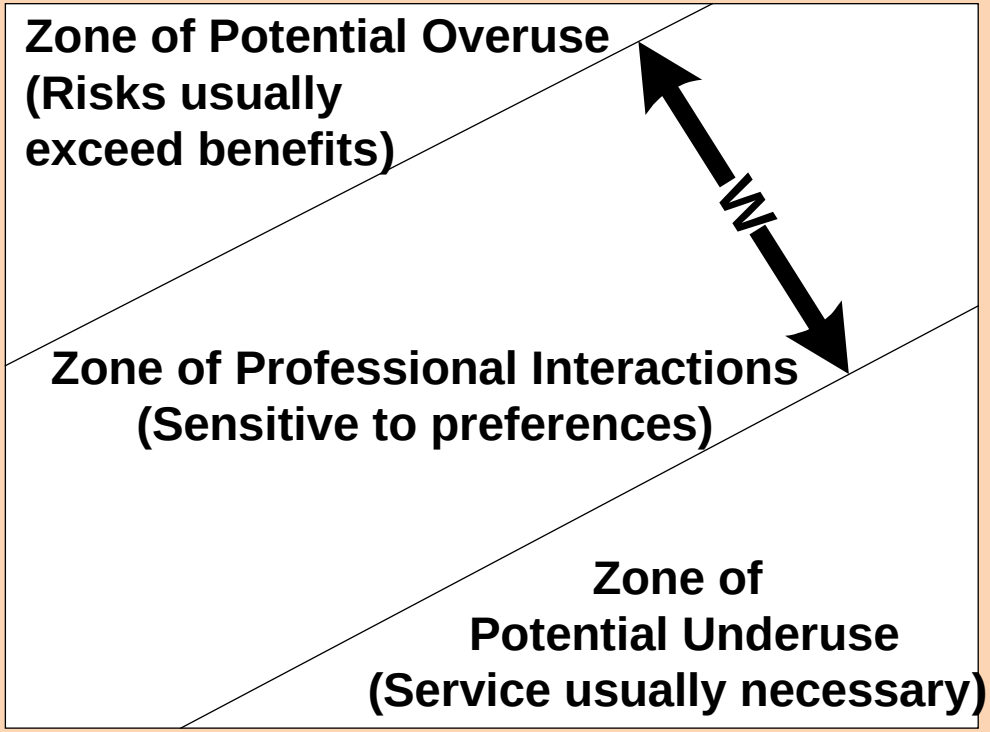
Our Approach

- Build Coalition of Strong Institutional Partners
  - Accreditors (TJC, NCQA)
  - Clinicians (AAP, AAFP, ACOG)
  - Consumers (Consumer Reports, IPFCC, NAMI)
  - Insurers
- Offered things of opposing value(s)
  - Overuse on the one hand
  - Validation of clinical process on the other

Explicitly incorporate uncertainty

- Example: CAPQuaM's Boundary Guideline
  - Incorporates evidence and uncertainty

Figure 2: Illustrating Boundary Guideline



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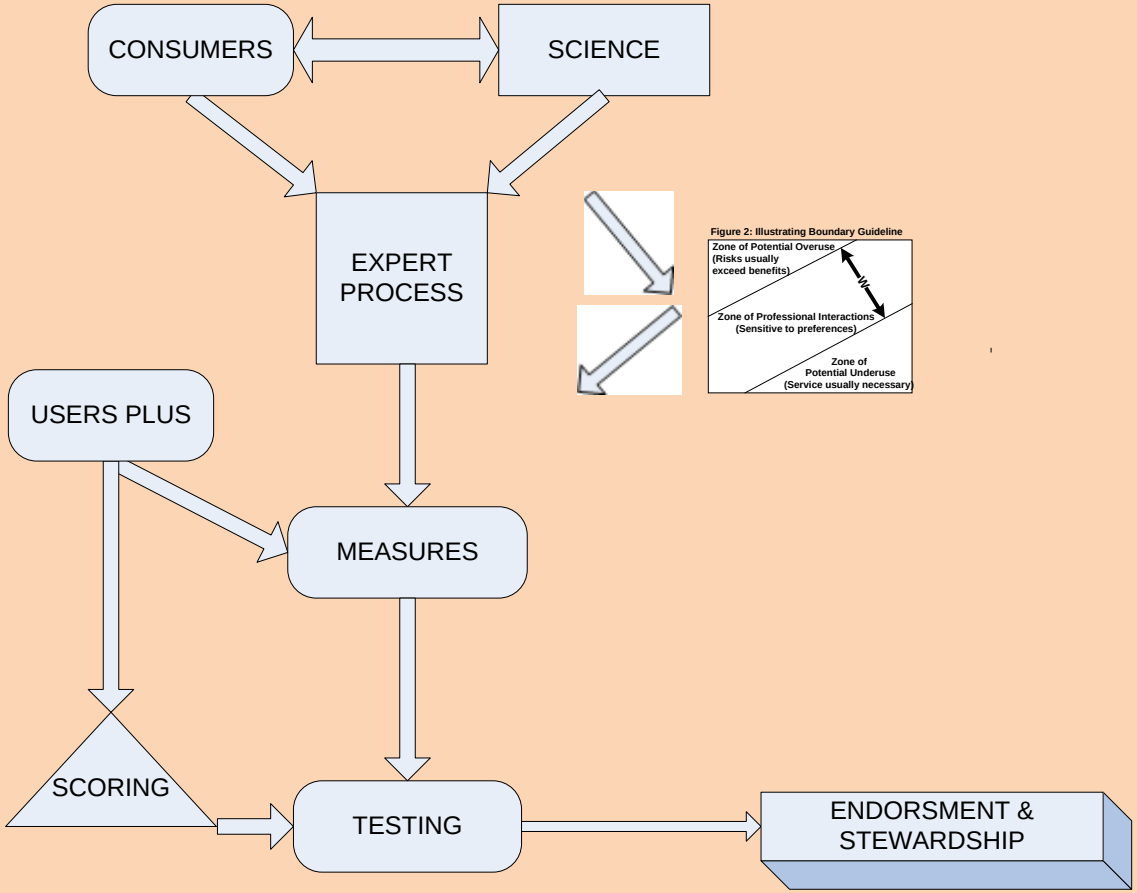
Develop Consensus around the Process, not the Measure



Engagement

- Consumer Stakeholders
  - Share their beliefs, priorities, values based upon relevant experiences (CFLR is novel)
- Clinician Stakeholders
  - Share their beliefs priorities, values and relevant experiences
  - Staff expert panels to develop criteria to support boundary guideline
- Organizational Stakeholders
  - Assist with specification of measures
  - Plan for interpretation of measures

Assigned Measures, Phase 1

- Availability of High Risk Ob Care
- Inpatient Perinatal
  - Temperature on admission to NICU
- ER Visits for Asthma
  - As an indicator of chronic asthma care
  - As an indicator of adequacy of primary care

Highly engaged and engineered approach

- Expert process, informed by science and stakeholders
- Anticipate that structured integration of literature, judgment, and engagement will be sufficient to meet evidence standards for federal endorsement

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Evidence: What do you see?