Implementation of the Asthma Control Test in a Primary Care Practice

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Abstract

Asthma is a chronic pulmonary condition that affects approximately 339 million people worldwide and causes approximately 1,000 deaths per day (Global Asthma Network, 2018). Despite this being a well-known chronic medical condition, approximately 50% of adults do not have their asthma controlled (CDC, 2018). The Asthma Control Test (ACT) was developed in 2004 as a brief screening questionnaire that assesses a patient's asthma control and recent symptoms (Nathan et al., 2004). The ACT is available in 35 languages, is free and widely available in print and online, and takes approximately one minute to conduct (American Thoracic Society, 2016). However, despite the availability and ease of use, many primary care practices are not using this important tool. This project evaluated the implementation of the ACT in a large primary care practice in Northern New Jersey and evaluated the impact it has on asthma outcomes. A brief, 15-minute educational session about the ACT and how to properly document the results in the electronic medical record was conducted for all medical providers, nurses, and medical assistants in internal medicine. A retrospective chart review was performed to assess for compliance with the ACT and documentation of the score, and to evaluate whether a change to the asthma management plan was initiated based on the result of the ACT score. It was found that after the brief educational session, the ACT was conducted on 28% of patients with a diagnosis of asthma, which is an improvement from the 15% of patients who had the Asthma Control Questionnaire performed prior to the intervention.

Keywords: asthma, asthma control test, ACT, asthma control, asthma symptoms, primary care, and asthma management

Implementation of the Asthma Control Test in Primary Care

Introduction

Asthma is a chronic pulmonary condition that involves inflammation and bronchoconstriction that can cause significant encumbrance and reduced quality of life. If left uncontrolled, it can lead to death (Centers for Disease Control and Prevention [CDC], 2018). Asthma can be controlled with appropriate treatment and clinical follow-up; however, 50% of adults have poorly controlled asthma (CDC, 2018). The Asthma Control Test (ACT), created by Nathan et al. (2004), is a brief questionnaire that helps assess a patient's asthma control. Assessing one's asthma control at every asthma visit in primary care is imperative in order to properly manage asthma symptoms and reduce exacerbations. Of particular concern are asthma exacerbations that may require an emergency department visit or hospital admission. If regularly administered, the medical provider may be able to identify a patient with worsening asthma symptoms, even before the patient realizes they are symptomatic. However, despite the easy accessibility of the ACT, many patients with asthma are still not controlled (CDC, 2018). Additionally, the ACT is not always conducted at primary care visits, causing a missed opportunity for medical providers to improve their patients' asthma severity.

Poor asthma control continues to be a significant global problem, particularly in low income, minority adults (CDC, 2019b). Puerto Ricans have the highest prevalence of asthma and asthma exacerbations of all ethnicities (CDC, 2019b). African Americans have a mortality rate over double that of any other ethnic group (CDC, 2019b). Also, the CDC (2019b) found that symptomatic, uncontrolled asthma contributes to the burden of asthma and results in reduced quality of life for these patients. Therefore, this quality improvement project will evaluate the

implementation of the ACT in an extensive primary care practice with the ultimate goal of improved asthma management.

Background and Significance

Asthma is a chronic inflammatory condition of the lungs that affects approximately 339 million people worldwide and causes 1,000 deaths every day (Global Asthma Network, 2018). Asthma is characterized by bronchial hyperresponsiveness, underlying inflammation, and airflow obstruction (Fanta, 2019). Seventy-five percent of asthma diagnosed in childhood is outgrown by adulthood; however, "new-onset" asthma in adulthood is not uncommon (Litonjua & Weiss, 2019). New diagnoses of asthma in adults are twice as common in women as in men and is also increased during perimenopausal years (Litonjua & Weiss, 2019).

In the United States (U.S.), 24 million people are estimated to be affected by asthma, accounting for approximately 9% of the population (CDC, 2018). Females are affected by asthma at a rate of two to one compared to males. In 2016, asthma was the primary diagnosis for over 108,000 hospital admissions, 1.2 million emergency department visits, and 7.3 million physician office visits in patients over 18 years of age in the U.S. (CDC, 2019b). Additionally, in 2017, a total of 3,379 adults died from asthma (CDC, 2019b). Of the adults with asthma, 11.8 million live below the federal poverty level (CDC, 2019b). It is estimated that the total national cost of treating asthma exceeds $80 billion annually, accounting for a substantial financial burden on the healthcare system (Inserro, 2018).

In New Jersey in 2017, over 600,000 or 8.6% of adults are diagnosed with asthma, which is lower than the national prevalence (CDC, 2019a). In 2014 in New Jersey, there were 633 emergency department visits per 100,000 people and 148 hospital admissions per 100,000 people related to asthma (New Jersey Department of Health [NJDOH], n.d.). In addition, there were 110

deaths in 2017 from asthma (CDC, 2019a). The two counties where this quality improvement project took place have high percentages of adults living with asthma. Bergen county in New Jersey has the highest number of adults with asthma in the state, with 52,445 people. However, due to the large geographical area and population in this county, this accounts for only 7.9% of Bergen county residents, less than the state average (NJDOH, 2014a). In Hudson county, there are 49,044 adults with asthma. However, due to its smaller geographic area and more condensed population, this accounts for 10.1% of the population, which is higher than the state average (NJDOH, 2014b).

It is estimated that 50% of American adults do not have their asthma under control (CDC, 2018). One tool that has been developed to assist in assessing a patient's asthma control is the Asthma Control Test (ACT). The ACT was developed in 2004 by Nathan et al. as a patient-based tool for evaluating asthma control. The ACT was created in efforts to prevent unnecessary emergency treatments of asthma. According to the National Heart, Lung, and Blood Institute (NHLBI) guidelines, the goal is to reduce the usage of rapid-acting beta$_2$-agonists such as albuterol. It focuses instead on increasing control of the symptoms of asthma (Nathan et al., 2004). The ACT focuses on identifying symptoms of uncontrolled asthma before the patient is in an acute exacerbation.

The ACT consists of five questions with self-reported answers that look at asthma symptoms over the past four weeks, how much of an impact they have had on one's life, and whether the patient feels their asthma is controlled or not. This tool has been robustly studied, has proven validity, and takes approximately one minute to complete. The systematic review conducted by Jia et al. (2013) compared the ACT to the Asthma Control Questionnaire (ACQ), another tool used to evaluate asthma control. The authors found that the ACT was superior in

predicting not-well controlled asthma over the ACQ. Also, the ACT has the benefit of being able to accurately assess a patient's asthma control based on their recent symptoms and without the use of spirometry, which is not always readily available in a primary care office, thus making it more appropriate than the ACQ for clinical practice (Jia et al., 2013). The score can range from five to 25, and any score of less than 19 signifies not-well controlled or poorly controlled asthma. A validated instrument for evaluating asthma control, such as the ACT, is recommended in the National Asthma Education and Prevention Program's Expert Panel Report 3 for routine use as part of asthma management (NHLBI, 2007).

A study conducted by Sangvai et al. (2017) specifically looked at implementing the ACT in a primary care practice. This quality improvement initiative was introduced with an ACT documentation goal of 70% and was able to achieve this goal within six months of its implementation. Their success demonstrates the ease of implementing the ACT in a primary care setting. Additionally, Kercsmar et al. (2017) found that implementing an improved asthma collaborative in an urban, mostly Medicaid insured population resulted in a 41% reduction in hospitalizations and a 42% reduction in emergency room visits for asthmatic patients. These studies highlight the need for improved asthma control in reducing the healthcare burden and cost and improving the quality of life in patients with asthma.

Despite the ease of availability and administration of the ACT, it is not always conducted during asthma visits in primary care. Literature is scarce on how often primary care providers utilize the ACT. Banasiak (2018) conducted a quality improvement study similar to this project in 2018. It showed that after an educational session about the ACT for providers, 82.6% of advanced practice nurses and 30.7% of medical residents were conducting the ACT on their asthmatic patients. The author also showed that only 30% of medical residents conducted the

ACT assessment; however, when completed, they appropriately adjusted the asthma patients' regime 100% of the time (Banasiak, 2018). Increased conduction of the ACT in primary care is paramount in improving asthma outcomes. As Banasiak (2018) discussed, even after an educational session about the ACT, there were still 70% of medical residents that were not routinely using this vital tool.

This quality improvement project was conducted at a large Federally Qualified Health Center (FQHC) in Hudson and Bergen counties in New Jersey. This FQHC sees primarily uninsured or underinsured African American and Hispanic patients, patients who have shown to have the highest incidence of asthma burden. Prior to this project, at this FQHC, the ACT was not being routinely conducted on individuals with asthma. Due to this, many patients with asthma are uncontrolled and have a high utilization rate of the emergency department for their asthma symptoms. The goal of this project was to provide education to the medical providers and staff on the importance of the ACT in the proper management of asthma, in the expectation of an increase the utilization and documentation of the ACT in the electronic medical record, and provider acknowledgment of the ACT score, with the ultimate intention of increased use of the ACT by medical providers and improved asthma outcomes.

Needs Assessment

There is a paucity of data on the utilization of the ACT in primary or specialty care offices, despite the recommendation by the NHLBI guidelines. A thorough review of the literature and contact with the manufacturer of the ACT, GlaxoSmithKline, has resulted in no information on the utilization of the ACT in primary care or specialty care offices. It has been well established in the research that asthma symptom questionnaires help clinicians better manage asthma and improve asthma outcomes (Banasiak, 2018; Gagne & Boulet, 2018;

Magnoni et al., 2017; Miedinger et al., 2011; NHLBI, 2007). This is a significant gap in the literature as asthma control questionnaires are a recommendation by the NHLBI, yet, there is minimal available data on whether or not it is being conducted.

Asthma control is lacking in New Jersey and across the United States. While data is unavailable about uncontrolled asthma in New Jersians, it is estimated to be uncontrolled in 50% of Americans (CDC, 2018). While none of the top 100 cities named the worst places to live with asthma are located in New Jersey, the entirety of the state lies directly in the middle of the high-risk Northeast-Mid-Atlantic asthma belt located between Baltimore, Maryland, and Springfield, Massachusetts (Asthma and Allergy Foundation of America, 2019). This area has been deemed high-risk for asthma due to the poor air quality, highly urbanized landscape, and difficulty getting access to asthma specialists (Asthma and Allergy Foundation of America, 2019). According to this report, further research is needed on a local, state, and federal level in order to improve asthma outcomes in this area (Asthma and Allergy Foundation of America, 2019).

New Jersey is doing poorly in progressing towards the state goals, which are developed based on the recommendations by the Center for Disease Control and Prevention's Healthy People 2020 (NJDOH, 2018). There are 10 asthma goals for Healthy People 2020, New Jersey is only exceeding the goal in one metric. New Jersey is not progressing as anticipated, and instead is negatively progressing towards decreasing the number of asthma deaths, decreasing asthma-related hospitalizations and emergency department visits in people over age 65, and increasing the number of adults with asthma action plans (NJDOH, 2018). The only metric New Jersey is exceeding at the goal of reducing asthma-related hospitalizations in young children (NJDOH, 2018). This data is based on baseline data per 100,000 population and goals established by the state (NJDOH, 2018).

The primary care practice where this project took place was not conducting the ACT in a structured location in the electronic medical record. Medical providers possibly were addressing the questions in the ACT during their history taking, however, the score and results of individual questions were not available in a structured location in the EMR from where the data could easily be queried. This primary care practice did however have the Asthma Control Questionnaire (ACQ) available as a structured questionnaire in the EMR. Unfortunately, the practice does not have the availability of spirometry, a necessary component of the ACQ. Because of this, the ACQ was not routinely being conducted by the medical providers. Since no standardized asthma control or symptom questionnaire was being conducted, asthma was not well-controlled or managed adequately at this practice.

In consideration of this project, a strengths, weaknesses, opportunities, and threats (SWOT) analysis was conducted. For this project, the strengths included a dedicated and supportive Chief Medical Officer, supportive Directors of internal medicine, buy-in from senior management, and the fact that the ACT is quick and easy to administer. The weaknesses included the numerous sites and a very large staff. This can make it difficult to ensure that all providers, nurses, and medical assistants attend the educational sessions as intended. The opportunities included the Uniform Data System (UDS), a national quality reporting system for all health centers, and their emphasis on proper asthma management, and that the ACT is recommended as part of the NHLBI asthma management guidelines. The threats to this project included an already overworked staff, very busy providers, and frequent turnover of staff and "floating" of staff to the various practice sites.

Problem Statement

Despite the prevalence and possible fatality of asthma, it is infrequently managed correctly in primary care; it is estimated that over 50% of adult patients with asthma are uncontrolled (CDC, 2018). This project will look at the implementation of the Asthma Control Test in an extensive primary care practice and see if after a brief educational session, if the adherence to provider conduction and documentation of the ACT is improved, and if changes were made to their asthma management based on the ACT score. The clinical question guiding this project is: how does implementing the Asthma Control Test in an extensive primary care practice influence provider documentation of the ACT score and improve asthma management?

Aims and Objectives

The aim of this project is to evaluate how implementing the Asthma Control Test will impact asthma outcomes in a primary care practice and improve and change practice for the management of asthma. The objectives of this project were:

- To implement of the ACT into the electronic medical record for this primary care practice.
- To provide a brief 15-minute educational session for all medical providers, nurses, and medical assistants on the importance of the ACT, when it should be conducted, and how it should be documented in the EMR.
- To evaluate whether the ACT was conducted for patients with asthma and if the score acknowledged by the provider, whether the diagnosis matches the ACT score (asthma is controlled or uncontrolled), and whether a change to the management of asthma was implemented based on the ACT score as advised by NHLBI guidelines.

Review of Literature

For this project, a comprehensive search of PubMed, CINAHL, and Medline was conducted using variations of the search terms of *Asthma Control Test; outcomes or results;* and *primary care*. Articles were limited to those published in English within the last ten years. The search for *Asthma Control Test* yielded 912 results in PubMed, but when the additional search term *primary care* was added, this yielded 70 results. When *Asthma Control Test* and *outcomes or results* were searched together, it yielded 166 results. In CINAHL and Medline, the same search terms were used. In CINAHL, the search term *Asthma Control Test* yielded 215 results; when the search term *primary care* was added, 190 results were available. *Asthma Control Test* and *outcomes or results* yielded six results. From these results, abstracts were evaluated, and a snowball approach was used to eliminate articles that were not relevant, duplicates, or did not answer the clinical question. Articles that explored medication therapy, asthma in pregnancy, studies with spirometry results as the primary outcome, pharmacist-led asthma management, and studies that included patients with co-existing chronic obstructive pulmonary disease (COPD) were excluded. A total of 14 articles were reviewed and critically appraised using the Johns Hopkins Model and included in the Table of Evidence (see Appendix A).

Five main themes were discovered throughout this literature review. First, the literature shows that the ACT is a valid and reliable tool that assesses symptoms and a cutoff score of < 19 indicates uncontrolled asthma (Jia et al., 2013; Ko et al., 2012 Schatz et al., 2006). Second, when poor asthma control is clearly identified by an ACT score of < 19, providers adjust medication in over 75% of the time (Banasiak, 2018; Magnoni et al., 2017). Third, it has been determined that despite being on an asthma controller medication, a high percentage of patients still have their asthma uncontrolled when the ACT score is accounted for (Holt, Sheahan, Mackey & Jacobsen,

2011; Magnoni et al., 2017; Miedinger et al., 2011; Price et al., 2019). Fourth, there is a significantly missed opportunity in primary care for assessing for asthma control as many adults do not present for regular asthma follow up visits, and instead present for respiratory visits, thus not leading to adequate assessment of asthma control (Gagne & Boulet, 2018; Price et al., 2019; Yawn, 2011). Lastly, implementing the ACT into a busy primary care practice is feasible, successful, and sustainable (Banasiak, 2018; Sangavi et al., 2017).

Validity and Reliability of ACT Cutoff Score

Guidelines by the NHLBI (2007) have already recommended the usage of an asthma symptom and control questionnaire in every visit for patients with asthma (NHLBI, 2007). The ACT has been robustly studied for validity and reliability, and many studies have come to the consensus that a cutoff value of 19 or below indicates not-well controlled asthma (Jia et al., 2013; Ko et al., 2012; Schatz et al., 2006). There have been numerous studies looking at the best cutoff score for not-well controlled asthma, which has been an inconsistency in the literature prior to the above mentioned studies. Schatz et al. (2006) was one of the first studies to evaluate the reliability and validity of the ACT. They compared various scores of the ACT with spirometry values and pulmonologist evaluations of asthma control and found that a cutoff score of 19 has the optimal sensitivity (71%) and sensitivity (71%) for detecting uncontrolled asthma. Ko et al. (2012) compared ACT scores with spirometry and fractional concentration of exhaled nitric oxide (FeNO) measurements along a brief timeline to assess for asthma control. Ko et al. (2012) concurred with the findings from Schatz et al (2006) that determined that 19 was a proper cutoff score for determining uncontrolled controlled asthma, and also can be a predictor in future asthma exacerbations. Jia et al. (2013), based on the results of their systematic review and meta-analysis, determined the ACT is superior for assessing asthma control in primary care when

compared to the ACQ. They also found that the ACT assessed asthma control significantly better in not-well controlled when compared to the ACQ ($p = 0.001$).

Medication Adjustment Based on ACT Score

Importantly, studies have found that when providers implement the ACT, an easy tool to identify uncontrolled asthma, the majority make changes to the asthma management plan (Banasiak, 2018; Magnoni et al., 2017). When Banasiak (2018) implemented the ACT into a primary care practice, 100% of providers made a change to the asthma management plan when uncontrolled asthma was identified by the ACT score. Magnoni et al. (2017) looked at patients presenting for both asthma symptoms and refills of medications and found that there was also significantly uncontrolled asthma in patients who were merely presenting for refills of their asthma medications, many of which who did not identify asthma symptoms until asked the questions in the ACT. These findings prompted providers to also adjust the asthma management plan, when providers mentioned that without the ACT score, they may not have. A literature review conducted by Yawn (2011) discussed the importance of assessing asthma symptoms at every visit, as opposed to just designated asthma follow up visits, as many patients are unaware of worsening asthma symptoms. These findings match the findings found by Banasiak (2018) and Magnoni et al. (2017) highlighting the importance of assessing for asthma control at every visit so there are no missed opportunities to adjust the asthma management plan if needed.

Asthma Controller Medications and Asthma Control

Despite many patients being on an asthma controller medication such as an inhaled corticosteroid, long-acting beta agonist, combo inhaled corticosteroid/long-acting beta agonist, or montelukast, many patients are still not well controlled when the ACT score is taken into account (Holt et al., 2011; Magnoni et al., 2017; Miedinger et al., 2011; Price et al., 2019). Holt et al.

(2011) looked at the implementation of the ACT to a large primary care practice in New Zealand and found that when comparing the ACT scores to the providers' assessment of asthma, 36% of patients had asthma that was not-well controlled by ACT score as opposed to comparison with the providers' assessment of their asthma. Many of these patients were already on asthma controller medications. Magnoni et al. (2017) found that of their patients on an inhaled corticosteroid-long acting beta agonist controller medication, 57% still had uncontrolled asthma based on their ACT score. They also found that when uncontrolled asthma was identified based on the ACT score, the asthma management plan was adjusted 76% of the time. Miedinger et al. (2011) also found, similar to Magnoni et al. (2017) and Holt et al. (2011), that despite regular controller medication, asthma control remains inadequate in the majority of the patients in their study.

Asthma Control Assessment in Primary Care

One of the major issues for asthma management in primary care is that adults do not present for regular asthma follow up visits and only present when symptoms are present. Additionally, providers are not adequately educated on how to assess for asthma symptoms at visits to make the needed adjustments in the asthma management plan. (Gagne & Boulet, 2018; Price et al., 2019; Yawn, 2011). This also shows there may be a major gap in provider knowledge and ability to enact asthma management guidelines. Gagne & Boulet (2018) found that providers reported barriers to implementing the ACT in primary care. While providers acknowledged that these asthma control questionnaires should be done routinely, they needed extra help in the form of continuing education units or additional office resources in order to implement them into practice. Price et al. (2019) also found that there was a very low number of providers who assessed for asthma control (4.9% of visits), however assessed for asthma control

more often at asthma or respiratory visits than at regular visits. However, these authors also found that there were major gaps in evidence-based asthma management in primary care. Asthma management plans were largely changed when patients presented for respiratory symptoms and asthma exacerbations as opposed to any other routine visit. Yawn (2011) further stresses the importance of evaluation of asthma symptoms at every visit, not just asthma follow up visits, as there are many missed opportunities to adjust asthma management if not assessed at every visit.

Feasibility of ACT in Primary Care

Lastly, it has been shown in the literature that the ACT can be implemented in a large primary care practice, and it has been shown to be successful and effective (Banasiak, 2018; Sangavi et al., 2017). Banasiak (2018) implemented the ACT into a primary care practice and while she had slow uptake for compliance due to the frequent turn-over of medical residents, she had 75% compliance with nurse practitioners for conducting the ACT and 100% compliance with all providers for adjusting asthma management plans when uncontrolled asthma was identified based on the ACT score. Sangavi et al. (2017) also implemented the ACT in a large primary care practice and found that provers had an over 70% compliance with conduction of the ACT not only at implementation, but also two years later.

Theoretical Framework

The theoretical framework guiding this DNP project was the Rosswurm and Larrabee model (see Appendix B). Rosswurm and Larrabee (1999) developed this model as a framework of guidance for nurses and healthcare professionals towards the implementation of evidence-based science. With the constant publication of research, guidelines, and clinical updates daily, it can be difficult for a practitioner to know what and how best to implement into their practice. By

looking at six steps in an organizational process, this model provides a framework for generating and integrating evidence-based findings into practice (Rosswurm & Larrabee, 1999).

According to the Rosswurm and Larrabee model (1999), the first step is to assess the practice's need for change. Step one, *Assess,* is where the meeting with stakeholders took place, and identification of the problem of poor asthma management was identified. Step two, *Link,* problems are associated with their interventions and specific outcomes (Rosswurm & Larrabee, 1999). Based on the NHLBI's guidelines, asthma symptoms must be a part of asthma assessment at every visit. Knowledge is conceptualized and organized in this step. Step three, *Synthesize,* integrates the best evidence (Rosswurm & Larrabee, 1999). It is here that research is conducted and combined with clinical judgment to determine the best practice and evidence, so the practice knows the goal they are trying to achieve. IRB approval will be attained in time. Step four, *Design,* is to project the practice change (Rosswurm & Larrabee, 1999). This step entailed creating clinical protocols, procedures, or standards of practice to be implemented. Here is where the blueprint was designed utilizing the electronic medical record at the primary care practice and the development of a brief educational program for the medical staff/providers regarding conduction and proper documentation of the ACT. Step five, *Implementation and Evaluation* is the practical implementation and evaluation of the change to see if the desired change occurred in practice; the protocol or procedure was implemented and re-evaluated (Rosswurm & Larrabee, 1999). Here is where this program was enacted, including the finalization of the ACT in the electronic medical record, conduction of the educational program, and collection of outcome measures. Step six, *Integration and Maintenance*, data was analyzed, and a follow-up email with the bullet points of the educational session was sent to all providers two weeks after the educational session as a reminder to conduct the ACT regularly. Additionally, based on the

results of this quality improvement study, the ACT may be included in the practices' asthma management guidelines with the goal of improved assessment of asthma control in all patients with asthma across all ages.

This theory was chosen for this project for multiple reasons. While this theory was initially developed for an acute-care setting, it can easily be translated into an outpatient practice, which is the location in which this project will be conducted. The six distinct, detailed steps will help guide the project from beginning to completion. This framework will assist in breaking down the clinical question and thoughtfully deciding on the appropriate steps, in the proper order, and is a straightforward guide to put research into practice.

Methodology

Setting

This project took place in a Federally Qualified Health Center (FQHC) in northern New Jersey. This practice saw a total of 51,237 patients in 2018 over the course of 190,919 visits. In 2018, this practice had 893 patients aged 18 and over with the diagnosis of asthma in 2018 and had 1,397 asthma visits. This equates to 1.56 visits per patient with asthma per year. The majority of the patients this practice sees are Hispanic or African American and low-income.

Study Population

This project evaluated the asthma control and asthma control test documentation in all patients seen at this practice in Northern New Jersey over the age of 18 with the diagnosis of asthma. The project participants were be mostly low-income and Hispanic, Black, or Caucasian, as this is the population this practice primarily sees. Exclusion criteria include patients who are pregnant, speak languages other than English or Spanish, or have a co-existing diagnosis of chronic obstructive pulmonary disease (COPD). Using Raosoft, Inc. (2004) for an a priori power

analysis to calculate sample size, a 5% margin of error and a 95% confidence level will be applied. Using this method the sample size was 200 participants, 100 for both pre-educational session and post-educational session, or up to six weeks of recruitment. This number was based on the fact that this office saw 1,397 asthma visits a year. When this number is divided by the number of months per year, it equals 116 asthma visits per month. When exclusion criteria were taken into consideration, up to 100 charts will be taken into consideration for each pre and post-intervention; up to 200 charts total or six weeks of evaluation.

Subject Recruitment

There was no recruitment as this is a retrospective chart review. Charts for the chart review were identified by the data analyst at this practice by extracting a list of all patients age 18 and over with the diagnosis with asthma from the EMR. The list was then provided to the Doctor of Nursing Practice (DNP) student (co-investigator). The co-investigator analyzed charts to see if they meet the inclusion and exclusion criteria.

Consent Procedure

A waiver of consent was obtained.

Risks and Harms

There were minimal risks with this project. With any retrospective chart review, there is a small chance of accidental disclosure of confidential health information. However, no identifying data was collected. Only research personnel had access to the data collected.

Subject Costs and Compensation

There was no cost to participate in this project. Additionally, subjects received no monetary compensation for their participation in this project.

Study Interventions

An educational session was provided to all internal medicine providers, nurses, and medical assistants in regard to the ACT and its documentation in the electronic medical record. An additional question asking if the patient is compliant with their asthma controller medication, if applicable, was added to the electronic medical record template to assess for compliance. The informal educational session was approximately 15 minutes long and discussed the importance of the ACT for the assessment and management of asthma, how and when the practice should hand out the ACT questionnaire, proper documentation of the results and final score in the electronic medical record, and provider acknowledgment of the ACT score.

During the educational sessions at each site, copies of the NHLBI's "Asthma Quick Care Reference for Diagnosing and Managing Asthma" were handed out to all providers (see Appendix C) (U.S. Department of Health and Human Services, 2012). Copies of the ACT were provided to the staff in English and Spanish. Patients with a diagnosis of asthma were asked to complete the questionnaire while in the waiting room or in the exam room while being processed by the medical assistants (See Appendix D). The medical assistants then inputted the answers and total score for the questionnaire into the electronic medical record. Providers were asked to acknowledge the ACT score by "timestamping" the box where the score is located, signifying that they evaluated the results of the questionnaire and final score.

Outcomes Measured

The primary tool used in this project is the Asthma Control Test, as developed by Nathan et al. (2004). This tool has been robustly studied and has been found to have a test re-test reliability of 0.77. It has shown to have a high internal consistency with a Cronbach alpha score of 0.85. It has also shown to be validated against pulmonologist's assessment of asthma severity

based on history, physical examination, and forced expiratory volume (FEV1) values on spirometry (American Thoracic Society, 2016).

There are two primary outcomes that were measured by this project. First, this project evaluated proper conduction and documentation of the ACT in the electronic medical record. This was done by a retrospective chart review to see if the ACT questionnaire was documented and if there is a "timestamp" from the provider acknowledging that they saw the results of the questionnaire and the final score. Second, all patients who have an ACT score of less than or equal to 19, indicating not-well controlled asthma, had further evaluation to see if there was a change in asthma management based on the ACT score. Documentation of compliance with medication was evaluated. If a patient stated they were not compliant with their medication, renewal of medications, including asthma controller medications if they have a diagnosis of persistent asthma, was considered a change to asthma management. Compliance with asthma controller medications has been shown to have better asthma outcomes and fewer asthma exacerbations (Engelkes, Janssens, de Jongste, Sturkenboom, & Verhamme, 2014). Demographic data including age, race and ethnicity, medications, insurance status, and diagnosis were collected in the data collection tool.

These results were compared to the “pre-intervention” group of the patients with the diagnosis of asthma who were seen prior to the intervention of the educational session. In the pre-intervention group, the charts were evaluated to see if the Asthma Control Questionnaire (ACQ), which is already implemented in the EMR was conducted, and if the questions of the ACT were addressed in the history taking. Additionally, if asthma was deemed uncontrolled, the charts were evaluated to see if a change to the asthma management plan was undertaken. This

was compared to the "post-intervention" charts of patients with asthma who were evaluated after the educational session for the providers and staff took place.

Project Timeline

This project was submitted to the Institutional Review Board (IRB) in April 2020 with approval in June 2020. As soon as approval was obtained, the ACT was implemented into the electronic medical record, and educational sessions were given to medical providers and staff. At that time, a retrospective chart review was done for all adults with asthma for the previous six weeks, evaluating whether the ACQ was conducted, evaluating the written history evaluated any of the questions in the ACT, and whether a change in the asthma management plan was undertaken. In late July, the six weeks of prospective data ended and data collection for the "post-intervention" patients with asthma was conducted. Data analysis of all data collected was conducted in July 2020 with the writing of the final project outcomes. The presentation and dissemination of the findings took place in August 2020 with the anticipated graduation of October 2020 (see Appendix E).

Resources Needed

The costs associated with this project were minimal and were the responsibility of the DNP student. Costs included printouts of the Asthma Quick Care Reference (2012) and the Asthma Control Test in English and Spanish for each of the practice's eight sites. A budget for this project is located in Appendix F.

Evaluation Plan

The goals for this project were to assess change in the difference between the usage of the ACQ before the educational session and the usage of the ACT afterward. Additionally, findings based on the history taking were compared to the assessment of asthma based on the diagnosis.

After the educational session, the diagnosis was compared to the ACT score to make sure they correspond, and if asthma is deemed as not-well controlled based on the ACT score, the asthma management plan was evaluated to see if a change was made.

Data Analysis

All data collected was entered into Microsoft excel spreadsheets. Descriptive statistics were used to describe the sample of participants from the charts reviewed. Descriptive statistics were also be used to compare retrospective and prospective chart review findings for the assessment of asthma symptoms using the ACQ or the ACT. All data was analyzed using Microsoft excel.

Maintenance and Security

All data collected during this project was stored on a password protected excel spreadsheet and was saved onto an encrypted flash drive. The only people who had access to this data were the investigator and co-investigator of this project. There was no identifying data collected. All data was stored within the project site, in a locked cabinet and the only people with access to the data were the investigator and co-investigator. Upon completion of this project, closure of the IRB, and final writing of the manuscript, all data will be destroyed in accordance with Rutgers University guidelines. Aggregate data will be stored at Rutgers School of Nursing 11th Floor Office 1126 at 65 Bergen Street; Newark, New Jersey 07107.

Results

Upon this completed chart review, a total of 200 charts were reviewed, 100 for each the pre-intervention and post-intervention groups. Both groups had roughly equal demographics, with the vast majority of patients identifying as Hispanic or Latino. The mean age of both groups was almost identical, being 51 and 52 respectively. All charts evaluated were of patients who

were either uninsured or underinsured, having New Jersey state Medicaid, or had Medicare, with the exception of seven patients who had private insurance (Appendix G). Lastly, the type of provider, whether Advanced Practice Nurse or Medical Doctor, was looked at for both groups and both groups were roughly even with 67% and 63% respectively having been seen by Medical Doctors. In the pre-intervention group, 15% of the visits were done via telehealth compared to 11% in the post-intervention group.

As was expected, the already embedded ACQ was not being routinely done by providers and was only conducted on 15% of the pre-intervention patients. Interestingly, these were all conducted by the same medical provider, with no other provider asking this questionnaire. However, because of the lack of availability of spirometry in the office, only the first two questions of the ACQ were answered, making it impossible to have a complete analysis of the patient's level of asthma control. Additionally, as expected, the ACT was not done at all on any of the pre-intervention patients despite the recommendation by the NHLBI. This means that 85% of charts evaluated for the pre-intervention group had no formal assessment of the patient's asthma symptoms. As seen in Appendix H, additional evaluation from the history section of the chart found that of the 100 charts evaluated, none had any mention as to whether the patient's asthma symptoms were interfering with their life in any way, 32% evaluated for presence of shortness of breath, 21% evaluated for the presence of nighttime symptoms, 18% discussed how frequently the patient was using their rapid-acting β2 agonist, and 17% documented the patient's thought on their level of asthma control. These low numbers show that the vast majority of patients had no documentation of anything related to their asthma symptoms or thoughts of level of control. Of the pre-intervention charts, 23% had changes to their asthma management plan,

70% had only their medication refilled, and 6% had absolutely nothing done, no changes and no medication refilled.

In the post-intervention group, 28% had completed the ACT. This is an improvement from the 15% who had incompletely conducted ACQ's in the pre-intervention group. Of the 28 completed ACTs, 2 were incomplete, with either 3 or 4 of the questions answered, making it impossible to get a final score. Also, of these 28 competed ACTs, 23 of them had provider acknowledgement of the results and score, noted by a "timestamp" from the provider under the score. In the post-intervention group, adherence to medication was documented as "yes" in 65% of the charts, the rest either had their adherence documented as "no" or there was no documentation of adherence. A change to the asthma treatment plan was made 32% of the time, 56% only had refills given, and 12% had no changes made nor refills given. This is also an improvement when compared to the pre-intervention group where only 23% had changes made to their asthma treatment plan.

Of the 26 ACTs that were completed in their entirety without any questions omitted, 65.4% had scores of 19 or less, showing asthma that is not well controlled. The mean ACT score was 16 and the median score was 15 (Appendix I). Of the 65% that were uncontrolled, 82.3% had changes made to their asthma treatment plan. Of the providers who saw the patients with uncontrolled asthma, it was divided roughly equally between MDs and APNs. All of the patients who were seen who had ACT scores >19 had no changes made to their treatment plans, and all had their medications refilled. Of the two ACTs that were incomplete, one did not document answers to questions four and five, and the other did not document answers to questions one and five. Of these, one had a change made to the asthma management plan and one did not. An additional 13 patients had changes to their asthma plan despite not having the ACT documented.

When looking at the scores to the individual questions of the ACT, question number three which asks about how often asthma symptoms wake you up at night or earlier than usual in the morning, had the lowest score with a mean of 2.92 (Appendix I).

Discussion

The results found from this quality improvement initiative showed that after introduction of the ACT to the clinical staff and inclusion of it directly into the EMR, the screening for asthma symptoms increased. These results coincide with the results found by Banasiak (2018) who implemented a very similar initiative in her primary care practice. However, Banasiak (2018) had a greater level of compliance with the ACT than this study found. The high level of uncontrolled asthma based off of the ACT score in this study is higher than the CDC's estimate of 50% uncontrolled asthma (CDC, 2018). This, in part, was due to the fact that this study was conducted in the middle of the COVID-19 pandemic in an area with a high percentage of COVID-19 positive patients.

It is difficult to say whether the increased number of patients who had their asthma management plans adjusted was due to increased screening or due to respiratory symptoms present due to COVID-19. If this project were done again, checking for COVID-19 status should be evaluated.

Limitations

The greatest limitation of this project was the timing it was completed. There was a slow uptake of the ACT for a number of reasons. The data analysis for this project was from April to July 2020, which was in the middle of the COVID-19 pandemic. During the educational sessions, it was difficult to get all staff there at one time, thus follow up emails had to be done, which often went unread. All staff was not able to be educated at once as originally planned

because some staff were not working, some were out on quarantine, and some were working in the isolation area and were not able to be pulled away for a short period of time. The COVID-19 pandemic caused the number of patients seen by this primary care practice to drop drastically, both because patients were fearful of coming into the office and because some of the clinical sites had to be closed due to lack of staff. In April, when data collection began, the practice was seeing about 40% of their usual volume, and in July the number was only up to 60% of their normal volume of patients. However, despite the decrease in volume, there were still 100 charts that were able to be evaluated in the six weeks before and after the educational session.

Additionally, it was noted that in the post-intervention charts, many of them were seen to rule out COVID-19 infection or after being diagnosed with COVID-19 for a follow up visit. Due to this, patients were often examined in the isolation area and their visits were briefer than a typical visit. This could account for the fewer-than-expected number of ACTs that were conducted.

Implications for Clinical Practice

One of the clinical practice implications of this project is improved asthma management. An improvement in asthma management can lead to reduced emergency department visits and hospital admissions, and less frequent primary care visits for worsening asthma symptoms. Increased frequency of asthma follow-up visits will lead to more frequent assessment of asthma symptoms and control, and better management of asthma. Improving asthma management may ultimately lead to increased reimbursement from insurance companies, in addition to providing better care for these patients.

Implementing the ACT in this primary care practice was not difficult, similar to the findings found by Sangavi et al (2017). It was very easy for the EMR specialist to incorporate it

into the EMR and was live as soon as it was finished. In a smaller practice, it would have been even easier due to the fact that there are less providers you need to get on board to conduct the ACT. However, within the first six weeks it was uploaded, it was still utilized at 28% of asthma visits at this large practice. As with anything new, it takes time for providers and medical staff to remember to complete it, especially when asked to do it at every visit and not just designated asthma follow up visits.

Implications for Healthcare Policy

Many states have implemented asthma quality improvement initiatives to reduce state healthcare costs in pediatrics, but there is little done to change health policy for adult asthma. Creating healthcare policies that address improvement in asthma control can have a profound economic effect in healthcare utilization costs, both nationally and locally. It is estimated that the total national cost of treating asthma exceeds $80 billion annually, accounting for a substantial financial burden on the healthcare system (Inserro, 2018). This accounts for direct costs such as medical office visits, medications, ED visits, and hospitalization costs. What this number does not account for is the indirect costs, such as school or work absenteeism, loss of productivity at work, or early mortality (Nunes, Pereira, & Morais-Almeida, 2017). Additionally, there are intangible costs such as decreased quality of life, increased suffering, and limitation in physical activity (Nunes, Pereira, & Morais-Almeida, 2017). The 20-year direct cost of asthma is expected to exceed $330 billion, and when indirect costs are added, the economic burden is expected to exceed $990 billion due to the nation's poor asthma control (Yaghoubi, Adibi, Safari, FitzGerald, & Sadatsafavi, 2019).

The more frequently the ACT is utilized, the more improved outcomes will be had. State legislators could lobby insurance companies for increased payments for providers who have

better asthma outcomes. Additionally, incentive dollars can be given by insurance companies for providers who conduct a standardized asthma screening tool such as the ACT. This could be cost-saving for both insurance companies and lead to a great reduction in healthcare dollars spent on asthma. States such as Michigan and Missouri teamed up with community programs in addition to medical providers to improve asthma outcomes and have had great success (CDC, 2015).

Implications for Quality and Safety

The potential healthcare quality and safety implications are improved asthma control and management, which in turn improves quality. Also, as asthma is better managed, the reduction in asthma exacerbations that are anticipated improves safety for these patients with asthma, as uncontrolled asthma has the potential to be fatal.

This study at the beginning helps establish a baseline ACT score. Additional visits will be needed in order to determine whether these scores worsen or improve, which will look at the quality of care delivered. Use of the ACT has been associated with an improvement in scores over time and a decrease in asthma exacerbations, emergency department visits, and hospitalizations (Kercsmar et al., 2017; Ko et al., 2012; Meidinger et al., 2011; Schatz et al., 2006). In 2018, the Cleveland Clinic's Asthma Center showed that 56% of their patients with asthma had an improvement in their ACT score of greater than or equal to three points upon follow up visit (Cleveland Clinic, 2019).

There has also been substantial evidence to show a correlation between improvement in ACT score over time and improvement in lung function and asthma-related quality of life (van Dijk et al., 2020). Additionally, worsening of the ACT scores over time and signify future risk for asthma-related adverse events (van Dijk et al., 2020). The ACT score, especially when

looked at over time, can improve both quality and safety. This improvement in quality of care delivered and patient safety should be of utmost importance for primary care offices that care for patients with asthma of all ages, especially as the medical model moves towards a quality-related reimbursement model.

Implications for Education

The potential educational implications of this project are increased and improved education for all medical providers and nurses, both in practice and students, on the importance of regular assessment of asthma control. The assessment of asthma symptoms and control needs to be addressed at every visit, not only at designated asthma visits, as asthma can improve or deteriorate at any time. If these symptoms are not regularly being assessed, it may be a missed opportunity to make necessary changes to the asthma management plan.

Incorporating the ACT into regular asthma education can engrain the importance of this tool and regular evaluation of asthma symptoms and control from the beginning, as opposed to trying to incorporate it into practice at a later date. Using literature that supports not only the importance of this tool, but also the improvement that comes from using it is a valuable part of education for asthma.

Dissemination/Professional Reporting

The results of this project were disseminated to Rutgers University via teleconference as part of the requirements for the Doctorate in Nursing Practice degree. These findings were also presented to the chief medical officer and directors of internal medicine and pediatrics at the project site. Lastly, the findings may be written up and submitted for potential publication in a nursing or medical journal.

Sustainability

This quality improvement project has excellent sustainability. The ACT is now integrated into the electronic medical record permanently. All providers, nurses, and medical assistants have been trained on when to conduct the ACT and how to document the results. The providers are aware of where the score is documented and have been modifying their management plans. While the global COVID 19 pandemic caused uptake of the initiative to be slow, it is predicted that it will continue to improve. It is anticipated that the continued improvement in asthma management and asthma outcomes will lead the practice to adjust their internal asthma management guidelines to incorporate the use of the ACT at every visit for all patients with asthma, in both pediatrics and internal medicine.

Conclusion

Despite the difficult timing of this project taking place during the COVID-19 pandemic, there was still an improvement among provider compliance for conducting a standardized asthma screening test, as well as an increase in patients who received a change to their asthma management program. It was not difficult to incorporate the ACT into the EMR. When the ACT was completed by the medical assistant, the provider looked at and acknowledged the score the majority of the time. Lastly, of the patients who were identified with uncontrolled asthma, 82.3% had changes made to the asthma treatment plan, which is anticipated to improve their asthma.

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Appendix A

Table of Evidence

Evidence based question: How will the implementation of the Asthma Control Test in a large primary care office impact asthma outcomes?

Article	Author, Date	Evidence Type	Sample, Sample Size, Setting	Study Findings that help answer EBP question	Limitations	Evidence Level & Quality
#1	Sangavi, S. et al. (2017)	Prospective design longitudinal cohort study	Children aged 4-18 with the diagnosis of asthma across 11 primary care centers n=8533	After educational sessions, EMR alerts, and standardized administration and documentation of the ACT, the authors were able to achieve > 70% compliance with the ACT administration and documentation and sustained this compliance for at least 2 years. Authors were able to successfully integrate administration and results documentation of the ACT in a large primary care network.	It had multiple overlapping interventions, thus the authors could not conclude the impact of an individual intervention. Their institutional support (asthma champions, incentives offered to providers) and EMR capabilities (the ability to create automated alerts) may not be applicable to other practices.	Research Level III, C, Low quality

					Outcomes on asthma control was not measured.	
#2	Magnoni, M.S. et al. (2017)	Observational cross-sectional study	145 General Practitioners (GP's) across Italy and Spain who each recruited 8 patients age 18 and above with the diagnosis of asthma, who presented to their office for either renewal of currently used anti-asthmatic drugs, or for worsening asthma symptoms. n=1375 patients evaluated	The level of asthma control in both countries is poor, almost 50% of patients' asthma was uncontrolled. Poor drug adherence to daily controller therapy is an important factor to deterioration of asthma control, and patients who came to the office with worsening symptoms were more likely to have discontinued their controller medications than those who presented for renewal of their medication. There was almost 30% of patients with uncontrolled asthma when presenting for medication renewal,	There was a non-random selection of patients, which may have led to the inclusion of more severe patients. High percentage of current or ex-smokers which have been shown to have higher than average deterioration of asthma symptoms. No control group present.	Research Level III, B, Good quality

				highlighting the need for the ACT to be done at every visit. When poor asthma control was identified, GP's made adjustments to medications in 75.8% of patients. In patients who presented with worsening asthma symptoms, 77.8% of them had uncontrolled asthma by ACT score < 20, whereas 28.6% had uncontrolled asthma by ACT score in the group presenting for prescription renewal ($p < 0.0001$). The use of the ACT may lead GP's to a more active intervention to improve asthma management, particularly in patients asking only for a refill of their medications.		

#3	Al Moamaryk, M., Al-Kordi, A., Al Ghobain, M. and Tamin, H. (2012)	Randomized controlled trial	Primary care patients age 18 and above with the diagnosis of asthma who had not received controller therapy in the past two months. n=90 (45 each group)	ACT was responsive to changes at the initiation of asthma treatment. Their results demonstrate usefulness of the ACT score for the initiation of asthma treatment in accordance with GINA guidelines. Utilization the initial ACT score to determine appropriate treatment led to an improvement of 2.9 units (on the GINA 1-4 score), which was greater than the 1.7-unit improvement when based on MD judgement alone ($p = 0.04$).	Utilization of the ACT is independent of the practitioner's clinical judgement. Those who used the GINA approach may have been augmented by the pre-study workshop which was conducted, thus contaminating the results in the GINA group. The use of the ACT score limits of 16 and 19, which are extrapolated from studies that assessed asthma control to make decisions about treatment adjustment and maintenance, may be difficult to use for decision of appropriate initial treatment step.	Research Level I, B, Good quality

#4	Gagne, M.E. and Boulet, L. (2018)	Cross-sectional survey	Primary care family physicians in Quebec, Canada N=46 n=43 completed surveys	Most of the asthma clinical practice guidelines were recognized by 80% of the MD's, however about 60% said they did not provide their patients with a referral for asthma education or a written asthma action plan for exacerbation management. 60% said they referred between 0-4 asthmatic patients to a specialist if asthma remained uncontrolled. Very few MD's reported scheduling regular follow-up appointments, underlining an important discontinuity of care. MD's found the usefulness of the clinical practice guidelines, yet few followed them, highlighting the need for improving compliance to the asthma guidelines in primary care.	Recruitment consisted of a limited sample of physicians. The questionnaire sent to physicians to determine their adherence to clinical practice guidelines was based on Canadian asthma clinical practice guidelines. Since results were self-reported, the percent of implementation could have been overstated.	Research Level III, B, good quality

				MD's reported that teamwork could help overcome the main identified barriers to asthma clinical practice guideline implementation, specifically the lack of time and resources.		
#5	Schatz, M. et al (2006)	Longitudinal study	Patients 12 years of age and older who had not seen an asthma specialist within the previous 5 years or had a diagnosis of asthma, with a mean age of 35 and the total range of 12-84 years old. n=313	Overestimation of asthma control can result in failure to use needed intervention or to make necessary adjustments to medication regimens, which can result in worsening asthma control and in some cases death. The ACT is reliable, valid, and responsive to changes in asthma control over time in a sample of patients new to the care of an asthma specialist. Internal consistency reliability of ACT is 0.85 at baseline and 0.79 at follow up.	This population was seen in specialty care but was more similar to those seen in primary care.	Research Level III, B, good quality

				Test re-test reliability is 0.77. ACT scores of < 19 has a 71% specificity and 71% sensitivity for detecting uncontrolled asthma. This population may be more representative of patients seen in the primary care setting than in specialty care setting. The ACT was specifically designed to be used in primary care physician's offices, because it consists of five questions and is quick to administer, thus allowing for the time constraints most PCP's feel as they are seeing more patients with limited time. The correlations between ACT scores and FEV1 values were		

				substantially lower than expected, which is consistent with the findings from other studies that suggested that asthma control cannot be inferred from single measures of lung function.		
#6	Price, C. et al (2019)	Prospective, longitudinal cohort study	Primary care providers in Canada, and their patients with the diagnosis of asthma. N=43 n=23 physicians N=3 n=1 Nurse practitioners Of their patients, n=4122 patients were assessed	Asthma control assessments were seldom performed, but more performed more often if asthma or respiratory symptoms were their presenting chief complaint. 85% of patients did not have their asthma control assessed despite an average of approximately five visits over the year with 37% of patients having at least one visit with a respiratory symptom. 74% of those with poor control already on a high dose ICS were not prescribed an add-on LABA.	No inclusion of allied health resources for asthma management. This study may have underestimated asthma action plan delivery due to poor chart documentation. Only 15.3% of patients had poor control documented, compared with the expected 59% of prevalence of poor control, supporting the presence of an assessment care gap. Although a validated algorithm to identify patients with asthma was used, some	Research Level III, B, good quality

					diagnostic miscalculations were likely to have occurred.	
#7	Ko, F. et al (2011)	Prospective study	Patients with the diagnosis of asthma aged 18-80 years old, excluding current smokers or ex-smokers with a pack year history of ≥ 10 years, in a university respiratory clinic. n= 379	Baseline ACT score was associated with exacerbations and urgent medical visits at 6 months ($p < 0.001$), whereas FeNO ($p = 0.16$) and spirometry values (pre-bronchodilator FEV1 $p = 0.33$, post-bronchodilator FEV1 $p = 0.19$) had no association with exacerbations at 6 months. Serial ACT scores were only weakly associated with the doctor's decision of changing the asthma therapy. The authors found that an ACT score cut-off value of ≤ 19 is appropriate for	Many patients were on ICS, which may have suppressed the FeNO values, making it less useful. This study took place in one location, with a relatively short follow up period.	Research Level III, B good quality

				identifying uncontrolled asthma and ≤ 22 for partially controlled asthma as defined by the GINA guidelines.		
#8	Miedinger, D., Neukomm, E., Chhajed, P. N., Schnyder, A., Naef, M., Ackermann, M., & Leuppi, J.D. (2011)	Cross-sectional survey	A survey was given to primary care physicians and specialists (pulmonologists, allergists, and pediatricians) about asthma control in their adolescent and adult patients in Switzerland. Mean age was 48 years with a range of 10-96 years. n=277 physicians n=1093 patients with asthma	Only 11.5% of patients assessed had completely controlled asthma based on their ACT score, despite that almost 90% reported to be using a controller medication. 44% of patients were found to have an ACT score of ≤ 19 indicating uncontrolled asthma. The authors found that a lower cut-off score for uncontrolled asthma leads to a lower sensitivity and higher specificity, thus the authors determined that a cut-off point of ≤ 17 is a good screener for uncontrolled asthma in this population. Asthma patients on controller medications such as ICS were more	Only the adult version of the ACT was used, which has only been validated in patients age 12 and up, however, there were a few patients included in this study who were less than 12 years old.	Research Level III, C, Low quality

				likely to have controlled asthma and patients suffering from insufficiently controlled asthma were more often using short-acting reliever medication and not ICS.		
#9	Jia, C. E. et al (2012)	Systematic Review	Literature review from searches in PubMed, CENTRAL, Web of Science, Ovid, and Embase 21 studies with 11,141 subjects assessed with the ACT and 12,483 assessed with the ACQ were identified.	The ACT provided a good diagnostic accuracy for assessments of controlled and not well-controlled asthma. Neither the ACT nor ACQ were useful for assessing uncontrolled asthma. For the assessment of not well-controlled asthma, the 95% confidence intervals of the ACT were much narrower than those of the ACQ, indicating that the estimation precision was greater for the ACT than the ACQ. The proportions of validation for the ACQ	No clear definitions of asthma control have been provided, and neither the NAEPP or GINA guidelines are considered reference gold standards for the assessment of asthma control. The diagnostic accuracies between some subgroups were not statistically compared because of the limited number of studies. The differences in the diagnostic accuracies of the ACT and ACQ mainly originated from indirect comparisons rather	Non-Research Level V, A, high quality

				were very low when compared to the proportions for the ACT, which would overestimate the performance of the ACQ and weaken generalization for clinical practice. The ACT provides a simpler assessment of control than the ACQ and does not require the use of spirometry, thus it is more useful for clinical practice, especially when the provider is seeing a high-volume of patients in a short period of time. The ACQ is better suited for clinical research.	than head-to-head comparisons. There was some obvious heterogeneity among included studies that affected the meta-analysis.	
#10	Banasiak, N. C. (2018)	Pre- and post-implementation quality improvement study	Convenience sample of children aged 4-14 with a diagnosis of asthma seen in the pediatric primary care center.	After the educational session, medical residents examined and documented the ACT scores on 30.7% of patients and nurse practitioners examined and documented the ACT score on 82.6% of	There was a biweekly change in the resident staff clinical rotation, making it difficult to properly educate all medical providers. The attending staff and chief residents who were precepting the	Non-Research Level V, B, good quality

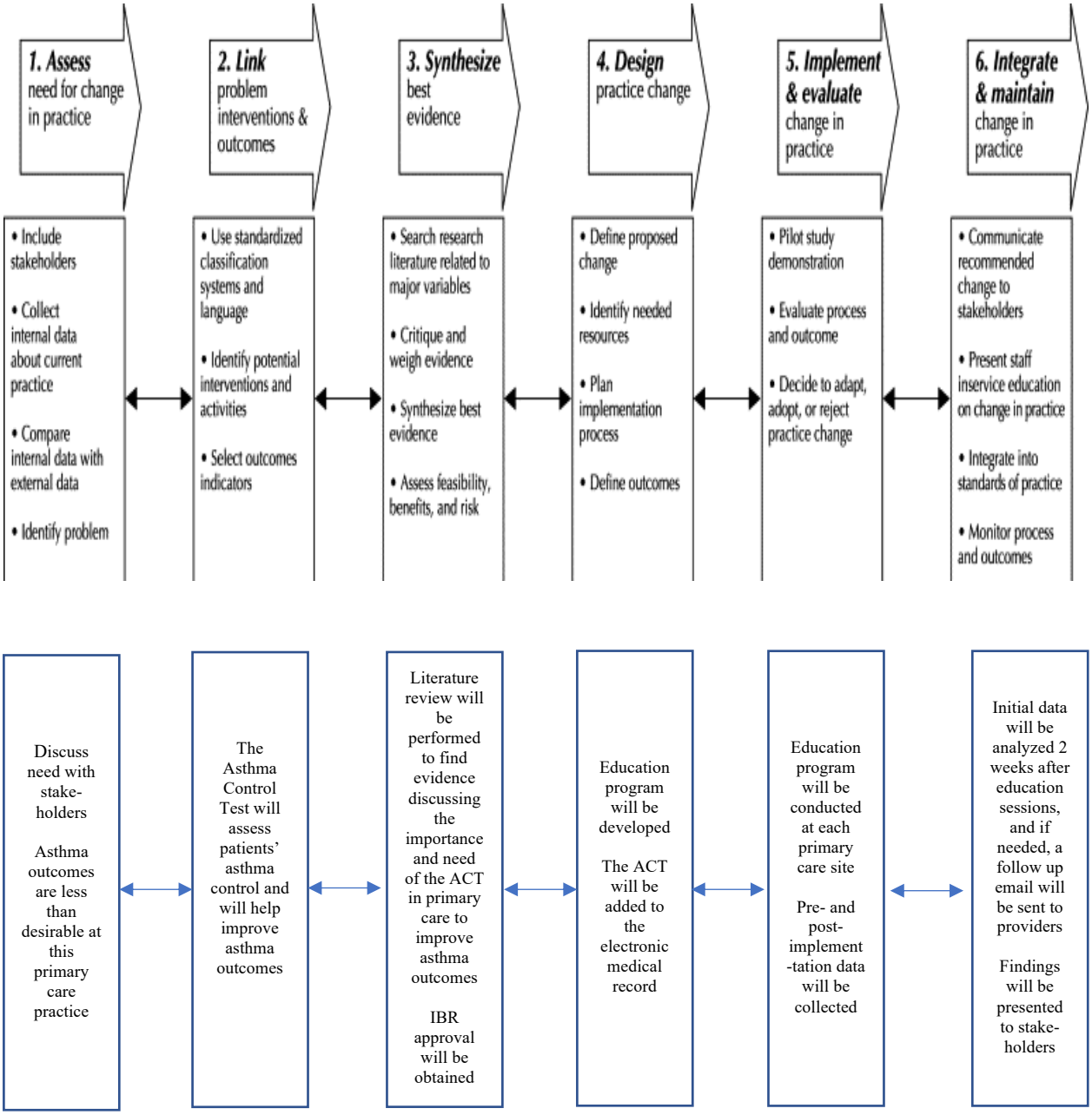
			A brief educational session was given to resident physicians and nurse practitioners about the ACT. N=58 medical professionals n= 31 attended the educational session n=199 patients with asthma evaluated	patients seen with asthma. A total of 43% of patients with asthma had the ACT conducted after the educational session. Of the patients who received the ACT, 21% were deemed not well-controlled or uncontrolled asthma, and 100% of these received a change to their medication regimen. The use of the ACT identified more patients with uncontrolled asthma (21%) versus the use of a careful history (9%).	residents were not included in the educational program. There was no measurement of providers' knowledge and understanding of the ACT before the educational program. This study did not consider the ability of the parents or child to understand the questionnaire.	
#11	Yawn, B. (2011)	Literature review	A literature search of PubMed from 2000-2010	Few adults with asthma currently have designated asthma "checkup" visits, usually seeking care only when in exacerbation. Therefore, asthma control needs to be assessed at every visit.	Since this was a literature review, lack of rigor is a limitation.	Non-Research Level V, B, good quality

				Tools such as the ACT, ACQ, and ATAQ provide easy ways to capture information about asthma control.		
#12	Holt, S., Sheahan, D., Mackey, B., & Jacobsen, C. (2011)	Case report	An audit of asthma control using the ACT was undertaken by 11 primary care physicians in 3 medical practices in New Zealand.	The mean ACT score was 18.9% which represents not well-controlled asthma. In about 50% of patients, the ACT score was different than anticipated by the MD, being worse in 66% and better in 33% of patients. The use of the ACT by primary care providers may lead to a more accurate assessment of asthma control.	None stated	Non-Research Level V, C, low quality
#13	National Heart, Blood, and Lung Institute (2007)	Clinical practice guidelines	N/A	Using a standardized, reliable, and valid asthma control questionnaire, such as the ACT, is recommended in recognizing asthma symptoms.	None stated	Non-Research Level IV, A, high quality

				The scores of these questionnaires are useful in deciding if there is a need to step-up or step-down medication therapy. These questionnaires assist with determination of asthma severity.		

Appendix B

Theoretical Framework



Adapted from "A model for change to evidence-based practice," by M. Rosswurm and J. Larrabee, 1999, *Image—The Journal of Nursing Scholarship 31*(4), 317–322.

Appendix C

Asthma Care Quick Reference Guide

Asthma Care **Quick Reference**

DIAGNOSING AND MANAGING ASTHMA

Guidelines from the National Asthma Education and Prevention Program

EXPERT PANEL REPORT 3

The goal of this asthma care quick reference guide is to help clinicians provide quality care to people who have asthma.

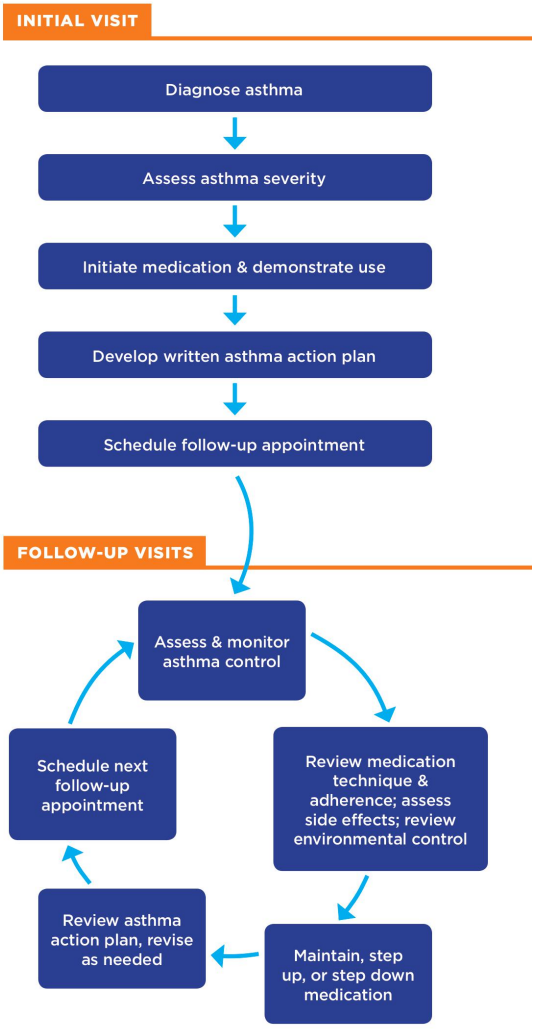
Quality asthma care involves not only initial diagnosis and treatment to achieve asthma control, but also long-term, regular follow-up care to maintain control.

Asthma control focuses on two domains: (1) **reducing impairment**—the frequency and intensity of symptoms and functional limitations currently or recently experienced by a patient; and (2) **reducing risk**—the likelihood of future asthma attacks, progressive decline in lung function (or, for children, reduced lung growth), or medication side effects.

Achieving and maintaining asthma control requires providing appropriate medication, addressing environmental factors that cause worsening symptoms, helping patients learn self-management skills, and monitoring over the long term to assess control and adjust therapy accordingly.

The diagram (right) illustrates the steps involved in providing quality asthma care.

This guide summarizes recommendations developed by the National Asthma Education and Prevention Program's expert panel after conducting a systematic review of the scientific literature on asthma care. See **www.nhlbi.nih.gov/guidelines/asthma** for the full report and references. Medications and dosages were updated in September 2011 for the purposes of this quick reference guide to reflect currently available asthma medications.



U.S. Department of Health and Human Services
National Institutes of Health
National Heart, Lung, and Blood Institute

KEY CLINICAL ACTIVITIES FOR QUALITY ASTHMA CARE

(See complete table in *Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma* [EPR-3])

Clinical Issue	Key Clinical Activities and Action Steps
➡ ASTHMA DIAGNOSIS	

	Establish asthma diagnosis.
	▪ Determine that symptoms of recurrent airway obstruction are present, based on history and exam.
	  • History of cough, recurrent wheezing, recurrent difficulty breathing, recurrent chest tightness
	  • Symptoms occur or worsen at night or with exercise, viral infection, exposure to allergens and irritants, changes in weather, hard laughing or crying, stress, or other factors
	▪ In all patients ≥5 years of age, use spirometry to determine that airway obstruction is at least partially reversible.
	▪ Consider other causes of obstruction.

➡ LONG-TERM ASTHMA MANAGEMENT	
GOAL: Asthma Control	**Reduce Impairment** ▪ Prevent chronic symptoms. ▪ Require infrequent use of short-acting beta$_2$-agonist (SABA). ▪ Maintain (near) normal lung function and normal activity levels. **Reduce Risk** ▪ Prevent exacerbations. ▪ Minimize need for emergency care, hospitalization. ▪ Prevent loss of lung function (or, for children, prevent reduced lung growth). ▪ Minimize adverse effects of therapy.

Assessment and Monitoring	**INITIAL VISIT: Assess asthma severity to initiate treatment** (see page 5)**.**
	FOLLOW-UP VISITS: Assess asthma control to determine if therapy should be adjusted (see page 6)**.**
	▪ Assess at each visit: asthma control, proper medication technique, written asthma action plan, patient adherence, patient concerns.
	▪ Obtain lung function measures by spirometry at least every 1–2 years; more frequently for asthma that is not well controlled.
	▪ Determine if therapy should be adjusted: Maintain treatment; step up, if needed; step down, if possible.
	
	Schedule follow-up care.
	▪ Asthma is highly variable over time. See patients:
	  • Every 2–6 weeks while gaining control
	  • Every 1–6 months to monitor control
	  • Every 3 months if step down in therapy is anticipated

Use of Medications	**Select medication and delivery devices that meet patient's needs and circumstances.** ▪ Use stepwise approach to identify appropriate treatment options (see page 7). ▪ Inhaled corticosteroids (ICSs) are the most effective long-term control therapy. ▪ When choosing treatment, consider domain of relevance to the patient (risk, impairment, or both), patient's history of response to the medication, and willingness and ability to use the medication. **Review medications, technique, and adherence at each follow-up visit.**

KEY CLINICAL ACTIVITIES FOR QUALITY ASTHMA CARE *(continued)*

Clinical Issue	Key Clinical Activities and Action Steps
Patient Education for Self-Management	**Teach patients how to manage their asthma.** ▪ Teach and reinforce at each visit: • Self-monitoring to assess level of asthma control and recognize signs of worsening asthma (either symptom or peak flow monitoring) • Taking medication correctly (inhaler technique, use of devices, understanding difference between long-term control and quick-relief medications) – ***Long-term control medications*** (such as inhaled corticosteroids, which reduce inflammation) prevent symptoms. Should be taken daily; will not give quick relief. – ***Quick-relief medications*** (short-acting beta$_2$-agonists or SABAs) relax airway muscles to provide fast relief of symptoms. Will not provide long-term asthma control. If used >2 days/week (except as needed for exercise-induced asthma), the patient may need to start or increase long-term control medications. • Avoiding environmental factors that worsen asthma **Develop a written asthma action plan** in partnership with patient/family (sample plan available at *www.nhlbi.nih.gov/health/public/lung/asthma/asthma_actplan.pdf*). ▪ Agree on treatment goals. ▪ Teach patients how to use the asthma action plan to: • Take daily actions to control asthma • Adjust medications in response to worsening asthma • Seek medical care as appropriate ▪ Encourage adherence to the asthma action plan. • Choose treatment that achieves outcomes and addresses preferences important to the patient/family. • Review at each visit any success in achieving control, any concerns about treatment, any difficulties following the plan, and any possible actions to improve adherence. • Provide encouragement and praise, which builds patient confidence. Encourage family involvement to provide support. **Integrate education into all points of care involving interactions with patients.** ▪ Include members of all health care disciplines (e.g., physicians, pharmacists, nurses, respiratory therapists, and asthma educators) in providing and reinforcing education at all points of care.
Control of Environmental Factors and Comorbid Conditions	**Recommend ways to control exposures to allergens, irritants, and pollutants that make asthma worse.** ▪ Determine exposures, history of symptoms after exposures, and sensitivities. (In patients with persistent asthma, use skin or in vitro testing to assess sensitivity to perennial indoor allergens to which the patient is exposed.) • Recommend multifaceted approaches to control exposures to which the patient is sensitive; single steps alone are generally ineffective. • Advise all asthma patients and all pregnant women to avoid exposure to tobacco smoke. • Consider allergen immunotherapy by trained personnel for patients with persistent asthma when there is a clear connection between symptoms and exposure to an allergen to which the patient is sensitive. **Treat comorbid conditions.** ▪ Consider allergic bronchopulmonary aspergillosis, gastroesophageal reflux, obesity, obstructive sleep apnea, rhinitis and sinusitis, and stress or depression. Treatment of these conditions may improve asthma control. ▪ Consider inactivated flu vaccine for all patients >6 months of age.

ASTHMA CARE FOR SPECIAL CIRCUMSTANCES

Clinical Issue	Key Clinical Activities and Action Steps
Exercise-Induced Bronchospasm	**Prevent EIB.*** ▪ Physical activity should be encouraged. For most patients, EIB should not limit participation in any activity they choose. ▪ Teach patients to take treatment before exercise. SABAs* will prevent EIB in most patients; LTRAs,* cromolyn, or LABAs* also are protective. Frequent or chronic use of LABA to prevent EIB is discouraged, as it may disguise poorly controlled persistent asthma. ▪ Consider long-term control medication. EIB often is a marker of inadequate asthma control and responds well to regular anti-inflammatory therapy. ▪ Encourage a warm-up period or mask or scarf over the mouth for cold-induced EIB.
Pregnancy	**Maintain asthma control through pregnancy.** ▪ Check asthma control at all prenatal visits. Asthma can worsen or improve during pregnancy; adjust medications as needed. ▪ Treating asthma with medications is safer for the mother and fetus than having poorly controlled asthma. Maintaining lung function is important to ensure oxygen supply to the fetus. ▪ ICSs* are the preferred long-term control medication. ▪ Remind patients to avoid exposure to tobacco smoke.

MANAGING EXACERBATIONS

Clinical Issue	Key Clinical Activities and Action Steps
Home Care	**Develop a written asthma action plan** (see Patient Education for Self-Management, page 3)**.** **Teach patients how to:** ▪ Recognize early signs, symptoms, and PEF* measures that indicate worsening asthma. ▪ Adjust medications (increase SABA* and, in some cases, add oral systemic corticosteroids) and remove or withdraw from environmental factors contributing to the exacerbation. ▪ Monitor response. ▪ Seek medical care if there is serious deterioration or lack of response to treatment. Give specific instructions on who and when to call.
Urgent or Emergency Care	**Assess severity by lung function measures (for ages ≥5 years), physical examination, and signs and symptoms.** **Treat to relieve hypoxemia and airflow obstruction; reduce airway inflammation.** ▪ Use supplemental oxygen as appropriate to correct hypoxemia. ▪ Treat with repetitive or continuous SABA,* with the addition of inhaled ipratropium bromide in severe exacerbations. ▪ Give oral systemic corticosteroids in moderate or severe exacerbations or for patients who fail to respond promptly and completely to SABA. ▪ Consider adjunctive treatments, such as intravenous magnesium sulfate or heliox, in severe exacerbations unresponsive to treatment. **Monitor response with repeat assessment of lung function measures, physical examination, and signs and symptoms, and, in emergency department, pulse oximetry.** **Discharge with medication and patient education:** ▪ Medications: SABA, oral systemic corticosteroids; consider starting ICS* ▪ Referral to follow-up care ▪ Asthma discharge plan ▪ Review of inhaler technique and, whenever possible, environmental control measures

***Abbreviations:** EIB, exercise-induced bronchospasm; ICS, inhaled corticosteroid; LABA, long-acting beta$_2$-agonist; LTRA, leukotriene receptor antagonist; PEF, peak expiratory flow; SABA, short-acting beta$_2$-agonist.

INITIAL VISIT: CLASSIFYING ASTHMA SEVERITY AND INITIATING THERAPY

(in patients who are not currently taking long-term control medications)

Level of severity (Columns 2–5) is determined by events listed in Column 1 for both impairment (frequency and intensity of symptoms and functional limitations) and risk (of exacerbations). Assess impairment by patient's or caregiver's recall of events during the previous 2–4 weeks; assess risk over the last year. Recommendations for initiating therapy based on level of severity are presented in the last row.

Components of Severity		Intermittent			Persistent								
					Mild			Moderate			Severe		
		Ages 0–4 years	Ages 5–11 years	Ages ≥12 years	Ages 0–4 years	Ages 5–11 years	Ages ≥12 years	Ages 0–4 years	Ages 5–11 years	Ages ≥12 years	Ages 0–4 years	Ages 5–11 years	Ages ≥12 years
Impairment	Symptoms	≤2 days/week			>2 days/week but not daily			Daily			Throughout the day		
	Nighttime awakenings	0	≤2x/month		1–2x/month	3–4x/month		3–4x/month	>1x/week but not nightly		>1x/week	Often 7x/week	
	SABA* use for symptom control (not to prevent EIB*)	≤2 days/week			>2 days/week but not daily	>2 days/week but not daily and not more than once on any day		Daily			Several times per day		
	Interference with normal activity	None			Minor limitation			Some limitation			Extremely limited		
	Lung function		Normal FEV_1 between exacerbations	Normal FEV_1 between exacerbations									
	➧ FEV_1* (% predicted)	Not applicable	>80%	>80%	Not applicable	>80%	>80%	Not applicable	60–80%	60–80%	Not applicable	<60%	<60%
	➧ FEV_1/FVC*		>85%	Normal†		>80%	Normal†		75–80%	Reduced 5%†		<75%	Reduced >5%†
Risk	Asthma exacerbations requiring oral systemic corticosteroids‡	0–1/year			≥2 exacerb. in 6 months, or wheezing ≥4x per year lasting >1 day AND risk factors for persistent asthma	≥2/year		*Generally, more frequent and intense events indicate greater severity.*			*Generally, more frequent and intense events indicate greater severity.*		
		*Consider severity and interval since last asthma exacerbation. Frequency and severity may fluctuate over time for patients in any severity category. Relative annual risk of exacerbations may be related to FEV_1.**											
Recommended Step for Initiating Therapy *(See "Stepwise Approach for Managing Asthma Long Term," page 7)* *The stepwise approach is meant to help, not replace, the clinical decisionmaking needed to meet individual patient needs.*		Step 1			Step 2			Step 3	Step 3 medium-dose ICS* option	Step 3	Step 3	Step 3 medium-dose ICS* option or Step 4	Step 4 or 5
								Consider short course of oral systemic corticosteroids.					
		In 2–6 weeks, depending on severity, assess level of asthma control achieved and adjust therapy as needed. For children 0–4 years old, if no clear benefit is observed in 4–6 weeks, consider adjusting therapy or alternate diagnoses.											

* **Abbreviations:** EIB, exercise-induced bronchospam; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; ICS, inhaled corticosteroid; SABA, short-acting $beta_2$-agonist.

† Normal FEV_1/FVC by age: 8–19 years, 85%; 20–39 years, 80%; 40–59 years, 75%; 60–80 years, 70%.

‡ Data are insufficient to link frequencies of exacerbations with different levels of asthma severity. Generally, more frequent and intense exacerbations (e.g., requiring urgent care, hospital or intensive care admission, and/or oral corticosteroids) indicate greater underlying disease severity. For treatment purposes, patients with ≥2 exacerbations may be considered to have persistent asthma, even in the absence of impairment levels consistent with persistent asthma.

FOLLOW-UP VISITS: ASSESSING ASTHMA CONTROL AND ADJUSTING THERAPY

Level of control (Columns 2–4) is based on the most severe component of impairment (symptoms and functional limitations) or risk (exacerbations). Assess impairment by patient's or caregiver's recall of events listed in Column 1 during the previous 2–4 weeks and by spirometry and/or peak flow measures. Symptom assessment for longer periods should reflect a global assessment, such as inquiring whether the patient's asthma is better or worse since the last visit. Assess risk by recall of exacerbations during the previous year and since the last visit. Recommendations for adjusting therapy based on level of control are presented in the last row.

Components of Control		Well Controlled			Not Well Controlled			Very Poorly Controlled		
		Ages 0–4 years	Ages 5–11 years	Ages ≥12 years	Ages 0–4 years	Ages 5–11 years	Ages ≥12 years	Ages 0–4 years	Ages 5–11 years	Ages ≥12 years
Impairment	Symptoms	≤2 days/week	≤2 days/week but not more than once on each day	≤2 days/week	>2 days/week	>2 days/week or multiple times on ≤2 days/week	>2 days/week	Throughout the day		
	Nighttime awakenings	≤1x/month		≤2x/month	>1x/month	≥2x/month	1–3x/week	>1x/week	≥2x/week	≥4x/week
	Interference with normal activity	None			Some limitation			Extremely limited		
	SABA* use for symptom control (not to prevent EIB*)	≤2 days/week			>2 days/week			Several times per day		
	Lung function ➔ FEV_1* (% *predicted*) or peak flow (% *personal best*) ➔ FEV_1/FVC*	Not applicable	>80% >80%	>80% Not applicable	Not applicable	60–80% 75–80%	60–80% Not applicable	Not applicable	<60% <75%	<60% Not applicable
	Validated questionnaires† ➔ ATAQ* ➔ ACQ* ➔ ACT*	Not applicable	Not applicable	0 ≤0.75‡ ≥20	Not applicable	Not applicable	1–2 ≥1.5 16–19	Not applicable	Not applicable	3–4 Not applicable ≤15
Risk	Asthma exacerbations requiring oral systemic corticosteroids§	0–1/year			2–3/year	≥2/year		>3/year	≥2/year	
		Consider severity and interval since last asthma exacerbation.								
	Reduction in lung growth/Progressive loss of lung function	Not applicable	Evaluation requires long-term follow-up care.		Not applicable	Evaluation requires long-term follow-up care.		Not applicable	Evaluation requires long-term follow-up care.	
	Treatment-related adverse effects	*Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.*								
Recommended Action for Treatment *(See "Stepwise Approach for Managing Asthma Long Term," page 7)* *The stepwise approach is meant to help, not replace, the clinical decisionmaking needed to meet individual patient needs.*		*Maintain current step.* *Regular follow-up every 1–6 months.* *Consider step down if well controlled for at least 3 months.*			Step up 1 step	Step up at least 1 step	Step up 1 step	*Consider short course of oral systemic corticosteroids.* *Step up 1–2 steps.* *Reevaluate in 2 weeks to achieve control.*		
					Reevaluate in 2–6 weeks to achieve control. *For children 0–4 years, if no clear benefit observed in 4–6 weeks, consider adjusting therapy or alternative diagnoses.*					
					Before step up in treatment: *Review adherence to medication, inhaler technique, and environmental control. If alternative treatment was used, discontinue and use preferred treatment for that step. For side effects, consider alternative treatment options.*					

* **Abbreviations:** ACQ, Asthma Control Questionnaire©; ACT, Asthma Control Test™; ATAQ, Asthma Therapy Assessment Questionnaire©; EIB, exercise-induced bronchospasm; FVC, forced vital capacity; FEV_1, forced expiratory volume in 1 second; SABA, short-acting $beta_2$-agonist.

† Minimal important difference: 1.0 for the ATAQ; 0.5 for the ACQ; not determined for the ACT.

‡ ACQ values of 0.76–1.4 are indeterminate regarding well-controlled asthma.

§ Data are insufficient to link frequencies of exacerbations with different levels of asthma control. Generally, more frequent and intense exacerbations (e.g., requiring urgent care, hospital or intensive care admission, and/or oral corticosteroids) indicate poorer asthma control.

STEPWISE APPROACH FOR MANAGING ASTHMA LONG TERM

The stepwise approach tailors the selection of medication to the level of asthma severity (see page 5) or asthma control (see page 6). The stepwise approach is meant to help, not replace, the clinical decisionmaking needed to meet individual patient needs.

ASSESS CONTROL:

STEP UP IF NEEDED (first, check medication adherence, inhaler technique, environmental control, and comorbidities)

STEP DOWN IF POSSIBLE (and asthma is well controlled for at least 3 months)

At each step: Patient education, environmental control, and management of comorbidities

0–4 years of age

	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6
	Intermittent Asthma	**Persistent Asthma: Daily Medication** Consult with asthma specialist if step 3 care or higher is required. Consider consultation at step 2.				
Preferred Treatment†	SABA* as needed	low-dose ICS*	medium-dose ICS*	medium-dose ICS* + either LABA* or montelukast	high-dose ICS* + either LABA* or montelukast	high-dose ICS* + either LABA* or montelukast + oral corticosteroids
Alternative Treatment†,‡		cromolyn or montelukast				
	If clear benefit is not observed in 4–6 weeks, and medication technique and adherence are satisfactory, consider adjusting therapy or alternate diagnoses.					
Quick-Relief Medication	▪ SABA* as needed for symptoms; intensity of treatment depends on severity of symptoms. ▪ With viral respiratory symptoms: SABA every 4–6 hours up to 24 hours (longer with physician consult). Consider short course of oral systemic corticosteroids if asthma exacerbation is severe or patient has history of severe exacerbations. ▪ Caution: Frequent use of SABA may indicate the need to step up treatment.					

5–11 years of age

	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6
	Intermittent Asthma	**Persistent Asthma: Daily Medication** Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.				
Preferred Treatment†	SABA* as needed	low-dose ICS*	low-dose ICS* + either LABA,* LTRA,* or theophylline[(b)] **OR** medium-dose ICS	medium-dose ICS* + LABA*	high-dose ICS* + LABA*	high-dose ICS* + LABA* + oral corticosteroids
Alternative Treatment†,‡		cromolyn, LTRA,* or theophylline§		medium-dose ICS* + either LTRA* or theophylline§	high-dose ICS* + either LTRA* or theophylline§	high-dose ICS* + either LTRA* or theophylline§ + oral corticosteroids
		Consider subcutaneous allergen immunotherapy for patients who have persistent, allergic asthma.**				
Quick-Relief Medication	▪ SABA* as needed for symptoms. The intensity of treatment depends on severity of symptoms: up to 3 treatments every 20 minutes as needed. Short course of oral systemic corticosteroids may be needed. ▪ Caution: Increasing use of SABA or use >2 days/week for symptom relief (not to prevent EIB*) generally indicates inadequate control and the need to step up treatment.					

≥12 years of age

	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6
	Intermittent Asthma	**Persistent Asthma: Daily Medication** Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.				
Preferred Treatment†	SABA* as needed	low-dose ICS*	low-dose ICS* + LABA* **OR** medium-dose ICS*	medium-dose ICS* + LABA*	high-dose ICS* + LABA* **AND** consider omalizumab for patients who have allergies††	high-dose ICS* + LABA* + oral corticosteroid§§ **AND** consider omalizumab for patients who have allergies††
Alternative Treatment†,‡		cromolyn, LTRA,* or theophylline§	low-dose ICS* + either LTRA,* theophylline,§ or zileuton‡‡	medium-dose ICS* + either LTRA,* theophylline,§ or zileuton‡‡		
		Consider subcutaneous allergen immunotherapy for patients who have persistent, allergic asthma.**				
Quick-Relief Medication	▪ SABA* as needed for symptoms. The intensity of treatment depends on severity of symptoms: up to 3 treatments every 20 minutes as needed. Short course of oral systemic corticosteroids may be needed. ▪ Caution: Use of SABA >2 days/week for symptom relief (not to prevent EIB*) generally indicates inadequate control and the need to step up treatment.					

* **Abbreviations:** EIB, exercise-induced bronchospasm; ICS, inhaled corticosteroid; LABA, inhaled long-acting beta$_2$-agonist; LTRA, leukotriene receptor antagonist; SABA, inhaled short-acting beta$_2$-agonist.
† Treatment options are listed in alphabetical order, if more than one.
‡ If alternative treatment is used and response is inadequate, discontinue and use preferred treatment before stepping up.
§ Theophylline is a less desirable alternative because of the need to monitor serum concentration levels.
** Based on evidence for dust mites, animal dander, and pollen; evidence is weak or lacking for molds and cockroaches. Evidence is strongest for immunotherapy with single allergens. The role of allergy in asthma is greater in children than in adults.
†† Clinicians who administer immunotherapy or omalizumab should be prepared to treat anaphylaxis that may occur.
‡‡ Zileuton is less desirable because of limited studies as adjunctive therapy and the need to monitor liver function.
§§ Before oral corticosteroids are introduced, a trial of high-dose ICS + LABA + either LTRA, theophylline, or zileuton, may be considered, although this approach has not been studied in clinical trials.

ESTIMATED COMPARATIVE DAILY DOSAGES: INHALED CORTICOSTEROIDS FOR LONG-TERM ASTHMA CONTROL

	0–4 years of age			5–11 years of age			≥12 years of age		
Daily Dose	**Low**	**Medium***	**High***	**Low**	**Medium***	**High***	**Low**	**Medium***	**High***
MEDICATION									
Beclomethasone MDI†	N/A	N/A	N/A	80–160 mcg	>160–320 mcg	>320 mcg	80–240 mcg	>240–480 mcg	>480 mcg
40 mcg/puff				1–2 puffs 2x/day	3–4 puffs 2x/day		1–3 puffs 2x/day	4–6 puffs 2x/day	
80 mcg/puff				1 puff 2x/day	2 puffs 2x/day	≥3 puffs 2x/day	1 puff am, 2 puffs pm	2–3 puffs 2x/day	≥4 puffs 2x/day
Budesonide DPI†	N/A	N/A	N/A	180–360 mcg	>360–720 mcg	>720 mcg	180–540 mcg	>540–1,080 mcg	>1,080 mcg
90 mcg/inhalation				1–2 inhs† 2x/day	3–4 inhs† 2x/day		1–3 inhs† 2x/day		
180 mcg/ inhalation					2 inhs† 2x/day	≥3 inhs† 2x/day	1 inh† am, 2 inhs† pm	2–3 inhs† 2x/day	≥4 inhs† 2x/day
Budesonide Nebules	0.25–0.5 mg	>0.5–1.0 mg	>1.0 mg	0.5 mg	1.0 mg	2.0 mg	N/A	N/A	N/A
0.25 mg	1–2 nebs†/day			1 neb† 2x/day					
0.5 mg	1 neb†/day	2 nebs†/day	3 nebs†/day	1 neb†/day	1 neb† 2x/day				
1.0 mg		1 neb†/day	2 nebs†/day		1 neb†/day	1 neb† 2x/day			
Ciclesonide MDI†	N/A	N/A	N/A	80–160 mcg	>160–320 mcg	>320 mcg	160–320 mcg	>320–640 mcg	>640 mcg
80 mcg/puff				1–2 puffs/day	1 puff am, 2 puffs pm– 2 puffs 2x/day	≥3 puffs 2x/day	1–2 puffs 2x/day	3–4 puffs 2x/day	
160 mcg/puff				1 puff/day	1 puff 2x/day	≥2 puffs 2x/day		2 puffs 2x/day	≥3 puffs 2x/day
Flunisolide MDI†	N/A	N/A	N/A	160 mcg	320–480 mcg	≥480 mcg	320 mcg	>320–640 mcg	>640 mcg
80 mcg/puff				1 puff 2x/day	2–3 puffs 2x/day	≥4 puffs 2x/day	2 puffs 2x/day	3–4 puffs 2x/day	≥5 puffs 2x/day

* It is preferable to use a higher mcg/puff or mcg/inhalation formulation to achieve as low a number of puffs or inhalations as possible.

† **Abbreviations:** DPI, dry powder inhaler (requires deep, fast inhalation); inh, inhalation; MDI, metered dose inhaler (releases a puff of medication); neb, nebule.

ESTIMATED COMPARATIVE DAILY DOSAGES: INHALED CORTICOSTEROIDS FOR LONG-TERM ASTHMA CONTROL *(continued)*

	0–4 years of age			5–11 years of age			≥12 years of age		
Daily Dose	**Low**	**Medium***	**High***	**Low**	**Medium***	**High***	**Low**	**Medium***	**High***
MEDICATION									
Fluticasone MDI†	176 mcg	>176–352 mcg	>352 mcg	88–176 mcg	>176–352 mcg	>352 mcg	88–264 mcg	>264–440 mcg	>440 mcg
44 mcg/puff	2 puffs 2x/day	3–4 puffs 2x/day		1–2 puffs 2x/day	3–4 puffs 2x/day		1–3 puffs 2x/day		
110 mcg/puff		1 puff 2x/day	≥2 puffs 2x/day		1 puff 2x/day	≥2 puffs 2x/day		2 puffs 2x/day	3 puffs 2x/day
220 mcg/puff								1 puffs 2x/day	≥2 puffs 2x/day
Fluticasone DPI†	N/A	N/A	N/A	100–200 mcg	>200–400 mcg	>400 mcg	100–300 mcg	>300–500 mcg	>500 mcg
50 mcg/inhalation				1–2 inhs† 2x/day	3–4 inhs† 2x/day		1–3 inhs† 2x/day		
100 mcg/inhalation				1 inh† 2x/day	2 inhs† 2x/day	>2 inhs† 2x/day		2 inhs† 2x/day	≥3 inhs† 2x/day
250 mcg/inhalation						1 inh† 2x/day		1 inh† 2x/day	≥2 inhs† 2x/day
Mometasone DPI†	N/A	N/A	N/A	110 mcg	220–440 mcg	>440 mcg	110–220 mcg	>220–440 mcg	>440 mcg
110 mcg/inhalation				1 inh†/day	1–2 inhs† 2x/day	≥3 inhs† 2x/day	1–2 inhs† pm	3–4 inhs† pm or 2 inhs† 2x/day	≥3 inhs† 2x/day
220 mcg/inhalation					1–2 inhs†/day	≥3 inhs† divided in 2 doses	1 inh† pm	1 inh† 2x/day or 2 inhs† pm	≥3 inhs† divided in 2 doses

* It is preferable to use a higher mcg/puff or mcg/inhalation formulation to achieve as low a number of puffs or inhalations as possible.
† **Abbreviations:** DPI, dry powder inhaler (requires deep, fast inhalation); inh, inhalation; MDI, metered dose inhaler (releases a puff of medication); neb, nebule.

Therapeutic Issues Pertaining to Inhaled Corticosteroids (ICSs) for Long-Term Asthma Control

- **The most important determinant of appropriate dosing is the clinician's judgment of the patient's response to therapy.** The clinician must monitor the patient's response on several clinical parameters (e.g., symptoms; activity level; measures of lung function) and adjust the dose accordingly. Once asthma control is achieved and sustained at least 3 months, the dose should be carefully titrated down to the minimum dose necessary to maintain control.
- Some doses may be outside package labeling, especially in the high-dose range. Budesonide nebulizer suspension is the only inhaled corticosteroid (ICS) with FDA-approved labeling for children <4 years of age.
- Metered-dose inhaler (MDI) dosages are expressed as the actuator dose (amount leaving the actuator and delivered to the patient), which is the labeling required in the United States. This is different from the dosage expressed as the valve dose (amount of drug leaving the valve, not all of which is available to the patient), which is used in many European countries and in some scientific literature. Dry powder inhaler (DPI) doses are expressed as the amount of drug in the inhaler following activation.
- For children <4 years of age: The safety and efficacy of ICSs in children <1 year of age has not been established. Children <4 years of age generally require delivery of ICS (budesonide and fluticasone MDI) through a face mask that fits snugly over nose and mouth to avoid nebulizing in the eyes. Face should be washed after treatment to prevent local corticosteroid side effects. For budesonide, the dose may be given 1–3 times daily. Budesonide suspension is compatible with albuterol, ipratropium, and levalbuterol nebulizer solutions in the same nebulizer. Use only jet nebulizers, as ultrasonic nebulizers are ineffective for suspensions. For fluticasone MDI, the dose should be divided 2 times daily; the low dose for children <4 years of age is higher than for children 5–11 years of age because of lower dose delivered with face mask and data on efficacy in young children.

USUAL DOSAGES FOR OTHER LONG-TERM CONTROL MEDICATIONS*

Medication	0–4 years of age	5–11 years of age	≥12 years of age
Combined Medication (inhaled corticosteroid + long-acting beta$_2$-agonist)			
Fluticasone/Salmeterol — DPI† 100 mcg/50 mcg, 250 mcg/50 mcg, or 500 mcg/50 mcg MDI† 45 mcg/21 mcg, 115 mcg/21 mcg, or 230 mcg/21 mcg	N/A†	1 inhalation 2x/day; dose depends on level of severity or control	1 inhalation 2x/day; dose depends on level of severity or control
Budesonide/Formoterol — MDI† 80 mcg/4.5 mcg or 160 mcg/4.5 mcg	N/A†	2 puffs 2x/day; dose depends on level of severity or control	2 puffs 2x/day; dose depends on level of severity or control
Mometasone/Formoterol — MDI† 100 mcg/5 mcg	N/A†	N/A†	2 inhalations 2x/day; dose depends on severity of asthma
Leukotriene Modifiers			
Leukotriene Receptor Antagonists (LTRAs) Montelukast — 4 mg or 5 mg chewable tablet, 4 mg granule packets, 10 mg tablet	4 mg every night at bedtime (1–5 years of age)	5 mg every night at bedtime (6–14 years of age)	10 mg every night at bedtime
Zafirlukast — 10 mg or 20 mg tablet *Take at least 1 hour before or 2 hours after a meal. Monitor liver function.*	N/A†	10 mg 2x/day (7–11 years of age)	40 mg daily (20 mg tablet 2x/day)
5-Lipoxygenase Inhibitor Zileuton — 600 mg tablet *Monitor liver function.*	N/A†	N/A†	2,400 mg daily (give 1 tablet 4x/day)
Immunomodulators			
Omalizumab (Anti IgE†) — Subcutaneous injection, 150 mg/1.2 mL following reconstitution with 1.4 mL sterile water for injection *Monitor patients after injections; be prepared to treat anaphylaxis that may occur.*	N/A†	N/A†	150–375 mg subcutaneous every 2–4 weeks, depending on body weight and pretreatment serum IgE level
Cromolyn			
Cromolyn — Nebulizer: 20 mg/ampule	1 ampule 4x/day, N/A† <2 years of age	1 ampule 4x/day	1 ampule 4x/day
Methylxanthines			
Theophylline — Liquids, sustained-release tablets, and capsules *Monitor serum concentration levels.*	Starting dose 10 mg/kg/day; usual maximum: ▪ <1 year of age: 0.2 (age in weeks) + 5 = mg/kg/day ▪ ≥1 year of age: 16 mg/kg/day	Starting dose 10 mg/kg/day; usual maximum: 16 mg/kg/day	Starting dose 10 mg/kg/day up to 300 mg maximum; usual maximum: 800 mg/day
Inhaled Long-Acting Beta$_2$-Agonists (LABAs) – used in conjunction with ICS† for long-term control; LABA is NOT to be used as monotherapy			
Salmeterol — DPI† 50 mcg/blister	N/A†	1 blister every 12 hours	1 blister every 12 hours
Formoterol —DPI† 12 mcg/single-use capsule	N/A†	1 capsule every 12 hours	1 capsule every 12 hours
Oral Systemic Corticosteroids			
Methylprednisolone — 2, 4, 8, 16, 32 mg tablets **Prednisolone** — 5 mg tablets; 5 mg/5 cc, 15 mg/5 cc **Prednisone** — 1, 2.5, 5, 10, 20, 50 mg tablets; 5 mg/cc, 5 mg/5 cc	▪ 0.25–2 mg/kg daily in single dose in a.m. or every other day as needed for control ▪ Short course "burst": 1–2 mg/kg/day, max 60 mg/d for 3–10 days	▪ 0.25–2 mg/kg daily in single dose in a.m. or every other day as needed for control ▪ Short course "burst": 1–2 mg/kg/day, max 60 mg/d for 3–10 days	▪ 7.5–60 mg daily in single dose in a.m. or every other day as needed for control ▪ Short course "burst": to achieve control, 40–60 mg/day as single or 2 divided doses for 3–10 days

* Dosages are provided for those products that have been approved by the U.S. Food and Drug Administration or have sufficient clinical trial safety and efficacy data in the appropriate age ranges to support their use.

† **Abbreviations:** DPI, dry powder inhaler; IgE, immunoglobulin E; MDI, metered-dose inhaler; N/A, not available (not approved, no data available, or safety and efficacy not established for this age group).

The most important determinant of appropriate dosing is the clinician's judgment of the patient's response to therapy. The clinician must monitor the patient's response on several clinical parameters (e.g., symptoms; activity level; measures of lung function) and adjust the dose accordingly. Once asthma control is achieved and sustained at least 3 months, the dose should be carefully titrated down to the minimum dose necessary to maintain control.

RESPONDING TO PATIENT QUESTIONS ABOUT INHALED CORTICOSTEROIDS

Questions and varying beliefs about inhaled corticosteroids (ICSs) are common and may affect adherence to treatment. Following are some key points to share with patients and families.

- ICSs are the most effective medications for long-term control of persistent asthma. Because ICSs are inhaled, they go right to the lungs to reduce chronic airway inflammation. In general, ICSs should be taken every day to prevent asthma symptoms and attacks.
- The potential risks of ICSs are well balanced by their benefits. To reduce the risk of side effects, patients should work with their doctor to use the lowest dose that maintains asthma control, and be sure to take the medication correctly.
  - Mouth irritation and thrush (yeast infection), which may be associated with ICSs at higher doses, can be avoided by rinsing the mouth and spitting after ICS use and, if appropriate for the inhaler device, by using a valved holding chamber or spacer.
  - ICS use may slow a child's growth rate slightly. This effect on linear growth is not predictable and is generally small (about 1 cm), appears to occur in the first several months of treatment, and is not progressive. The clinical significance of this potential effect has yet to be determined. Growth rates are highly variable in children, and poorly controlled asthma can slow a child's growth.
- ICSs are generally safe for pregnant women. Controlling asthma is important for pregnant women to be sure the fetus receives enough oxygen.
- ICSs are not addictive.
- ICSs are not the same as anabolic steroids that some athletes use illegally to increase sports performance.

RESPONDING TO PATIENT QUESTIONS ABOUT LONG-ACTING BETA$_2$-AGONISTS

Keep the following key points in mind when educating patients and families about long-acting beta$_2$-agonists (LABAs).

- The addition of LABA (salmeterol or formoterol) to the treatment of patients who require more than low-dose inhaled corticosteroid (ICS) alone to control asthma improves lung function, decreases symptoms, and reduces exacerbations and use of short-acting beta$_2$-agonists (SABA) for quick relief in most patients to a greater extent than doubling the dose of ICS.
- A large clinical trial found that slightly more deaths occurred in patients taking salmeterol in a single inhaler every day in addition to usual asthma therapy* (13 out of about 13,000) compared with patients taking a placebo in addition to usual asthma therapy (3 out of about 13,000). Trials for formoterol in a single inhaler every day in addition to usual therapy* found more severe asthma exacerbations in patients taking formoterol, especially at higher doses, compared with those taking a placebo added to usual therapy. Therefore, the Food and Drug Administration placed a Black Box warning on all drugs containing a LABA.
- The established benefits of LABAs added to ICS for the great majority of patients who require more than low-dose ICS alone to control asthma should be weighed against the risk of severe exacerbations, although uncommon, associated with daily use of LABAs.
- LABAs should not be used as monotherapy for long-term control. Even though symptoms may improve significantly, it is important to keep taking ICS while taking LABA.
- Daily use should generally not exceed 100 mcg salmeterol or 24 mcg formoterol.
- It is not currently recommended that LABAs be used to treat acute symptoms or exacerbations.

* Usual therapy included a wide range of regimens, from those in which no other daily therapy was taken to those in which varying doses of other daily medications were taken.

Appendix D

Asthma Control Test

asthma.com

Name: _____ **Today's Date:** _____

ASTHMA CONTROL TEST™

Know your score.

The Asthma Control Test™ provides a numerical score to help you and your healthcare provider determine if your asthma symptoms are well controlled.

Take this test if you are 12 years or older. Share the score with your healthcare provider.

Step 1: Write the number of each answer in the score box provided.

Step 2: Add up each score box for the total.

Step 3: Take the completed test to your healthcare provider to talk about your score.

IF YOUR SCORE IS 19 OR LESS, **Your asthma symptoms may not be as well controlled as they could be. No matter what the score, bring this test to your healthcare provider to talk about the results.**

NOTE: If your score is 15 or less, your asthma may be very poorly controlled. Please contact your healthcare provider right away. There may be more you and your healthcare provider could do to help control your asthma symptoms.

					SCORE
1. In the past 4 weeks, how much of the time did your asthma keep you from getting as much done at work, school or at home?					
All of the time **[1]**	Most of the time **[2]**	Some of the time **[3]**	A little of the time **[4]**	None of the time **[5]**	.....
2. During the past 4 weeks, how often have you had shortness of breath?					
More than Once a day **[1]**	Once a day **[2]**	3 to 6 times a week **[3]**	Once or twice a week **[4]**	Not at all **[5]**	.....
3. During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?					
4 or more nights a week **[1]**	2 to 3 nights a week **[2]**	Once a week **[3]**	Once or twice **[4]**	Not at all **[5]**	.....
4. During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?					
3 or more times per day **[1]**	1 to 2 times per day **[2]**	2 or 3 times per week **[3]**	Once a week or less **[4]**	Not at all **[5]**	.....
5. How would you rate your asthma control during the past 4 weeks?					
Not Controlled at All **[1]**	Poorly Controlled **[2]**	Somewhat Controlled **[3]**	Well Controlled **[4]**	Completely Controlled **[5]**	.....

TOTAL: .....

Fecha de hoy: _____

Nombre y apellido del paciente: _____

PARA LOS PACIENTES:

Tome la Prueba de Control del Asma (Asthma Control Test™ – ACT) para personas de 12 años de edad en adelante.

Averigüe su puntaje. Comparta sus resultados con su médico.

Paso 1 Anote el número correspondiente a cada respuesta en el cuadro de la derecha.

Paso 2 Sume todos los puntos en los cuadros para obtener el total.

Paso 3 Llévele la prueba a su doctor para hablar sobre su puntaje total.

									PUNTAJE
1. En las últimas **4 semanas**, ¿cuánto tiempo le ha impedido su **asma** hacer todo lo que quería en el trabajo, en la escuela o en la casa?									
Siempre	1	La mayoría del tiempo	2	Algo del tiempo	3	Un poco del tiempo	4	Nunca	5	
2. Durante las últimas **4 semanas**, ¿con qué frecuencia le ha faltado aire?									
Más de una vez al día	1	Una vez por día	2	De 3 a 6 veces por semana	3	Una o dos veces por semana	4	Nunca	5	
3. Durante las últimas **4 semanas**, ¿con qué frecuencia sus síntomas del **asma** (respiración sibilante o un silbido en el pecho, tos, falta de aire, opresión en el pecho o dolor) lo/la despertaron durante la noche o más temprano de lo usual en la mañana?									
4 o más noches por semana	1	2 ó 3 veces por semana	2	Una vez por semana	3	Una o dos veces	4	Nunca	5	
4. Durante las últimas **4 semanas**, ¿con qué frecuencia ha usado su inhalador de rescate o medicamento en nebulizador (como albuterol)?									
3 o más veces al día	1	1 ó 2 veces al día	2	2 ó 3 veces por semana	3	Una vez por semana o menos	4	Nunca	5	
5. ¿Cómo evaluaría el control de su **asma** durante las **últimas 4 semanas**?									
No controlada, en absoluto	1	Mal controlada	2	Algo controlada	3	Bien controlada	4	Completamente controlada	5	
									TOTAL

Si obtuvo 19 puntos o menos, es posible que su asma no esté tan bien controlada como podría. Hable con su médico.

PARA LOS MÉDICOS:

La Prueba ACT:

- Ha sido convalidada clínicamente por espirometría y evaluaciones de especialistas[1]
- Tiene el apoyo de la American Lung Association (Asociación Americana del Pulmón)
- Consiste en un breve cuestionario de 5 preguntas al que el paciente responde independientemente y que puede ayudarle al médico a evaluar el asma de sus pacientes durante las últimas 4 semanas.

Referencia: 1. Nathan RA et al. *J Allergy Clin Immunol.* 2004;113:59-65.

Appendix E

Timeline of Project

Tasks	Planned start	Duration	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct
Presentation of project proposal to team members	1/15/20	2 weeks										
Submit to IRB	4/10/20	8 weeks										
Implement ACT into electronic medical record	4/1/20	2 weeks										
Educational sessions	4/15/20	1 week										
Retrospective chart review	4/22/20	4 weeks										
Prospective chart review	6/1/20	2 weeks										
Data analysis and final writing	7/1/20	6 weeks										
Presentation of findings	8/25/20	1 week										
Anticipated graduation	10/20	1 week										

Appendix F

Budget

Printing of Asthma Quick Care Reference	
11 pages in color x $0.52/page	
0.52 page x 11 pages x 17 copies for providers	97.24
Printing of Asthma Control Test	
2 pages x $0.12/page	
0.12/page x 2 (English & Spanish) x 8 sites	1.92
Poster	75.00
Total	$174.16

Appendix G

Demographic Information

	Pre-Intervention	Post-Intervention
Age (mean)	51	52
Ethnicity		
Non-Hispanic	5	13
Hispanic	89	73
African American	6	12
Insurance Status		
Uninsured	43	51
Medicaid/Medicare	54	45
Private	3	4
Provider Type		
Medical Doctor	67	63
Advanced Practice Nurse	33	37

Appendix H

	Was the ACQ completed?	Was the ACT completed in the history?	Was interference with life addressed in the history?	Was shortness of breath assessed in the history?	Were nighttime symptoms assessed in the history?	Was rapid acting β2-agonist usage assessed in the history?	Was patient's assessment of asthma control assessed in the history?
Yes	15	0	0	32	21	18	17
No	85	100	100	68	79	82	83

Appendix I

Descriptive Statistics for ACT

	ACT Q1	**ACT Q2**	**ACT Q3**	**ACT Q4**	**ACT Q5**	**ACT TOTAL SCORE**
Mean	3.667	3.571	2.929	2.963	3.192	16.154
Standard Error	0.261	0.238	0.300	0.269	0.215	1.048
Median	4	4	3	3	3	15
Mode	5	4	5	2	3	21
Standard Deviation	1.359	1.260	1.585	1.400	1.096	5.342