Pediatric Asthma Protocol

Chelsea Agricola

Arizona State University College of Nursing and Health Innovation

Background and Significance

Today, asthma is one of the most commonly encountered conditions in pediatrics, and evidence shows its incidence is increasing. Research among birth cohorts in Ontario show an increasing incidence of asthma is children under 8 years old ($p<.0001$) and a significant increase in hospitalizations at time of asthma diagnosis in children under 3 years old ($p<.001$), which demonstrate a growing population of children in need of asthma management by a primary care provider (Radhakrishnan et al., 2014).

Airway remodeling is a serious consequence of pediatric asthma that persists into adulthood increasing the risk of adult lung disease and has been shown to decrease the lung function of those affected as evidenced by a reduced forced expiratory volume (Ozge, 2016). Research is being conducted to better understand the causes and possible prevention strategies of remodeling, however, it is clear that airway remodeling is due to recurrent bronchoconstriction and inflammatory cells responding to airway inflammation and correct pharmacologic treatment to prevent exacerbations can decrease the effects of airway remodeling in children (Ozge, 2016). However, in order to prevent potential airway remodeling, patients must receive the appropriate categorization and management of asthma in their primary care setting.

The use of evidence based clinical guidelines to systematically treat and manage asthma became a common practice in the 1980's as providers noticed a significant increase in the prevalence, severity, and deaths associated with asthma (Reddy & Gupta, 2014). Many different organizations, institutions, and agencies have developed guidelines to be implemented in practices to provide an efficient, consistent approach to asthma management to improve patient's outcomes. In a purpose statement by Papadopoulos et al., (2012), several commonly used

pediatric asthma guidelines were compared to determine differences in evidence that could contribute to difficulty with implementation and found that the majority of guideline had similar core definitions and recommendation including evaluation of lung function using spirometry, a stepwise approach to medication management, and an overall holistic approach to asthma management. In addition to improving patient outcomes, the use of clinical guidelines can also result in a reduction of health care cost. In 2010, Grant, Bowen, Neidell, Prinz, and Redlener conducted a study to determine the cost of health savings that could be attributed to implementation of the NHLBI's ERP-3 guidelines into practice. As a result of more efficient management of patient's asthma when using the ERP-3 guidelines, savings were estimated to be $4,525.00 per asthma patient per year (Grant, Bowen, Neidell, Prinz, & Redlener, 2010). In addition to the cost savings, guideline implementation also lead to substantial changes in patient outcomes, including a significant reduction of the severity of asthma on follow-up ($P<.05$), increased prescription of a controlled medication in patients with persistent asthma ($P<.01$), and a reduction of emergency department visits for asthma ($p<.01$) (Grant, Bowen, Neidell, Prinz, & Redlener, 2010).

Szefler (2015) stated that asthma management has seen significant improvements through the integration of evidence based guidelines into electronic medical records to better monitor treatment and outcomes, and specifically emphasizes the need further such technology to better manage pediatric patients thereby preventing asthma related complications. A systematic review of asthma protocol implementation by Dexheimer, Borychki, Chui, Johnson, and Aronsky (2014) found that any type of guideline implementation, whether it be paper or computer based, increased health care provider's performance in 66% of implementation studies and improved

asthma patient outcomes in 36% of implementations studies with no implementation attempts showing a decrease in either patient's outcomes or provider performance.

Internal Evidence

Evidence shows that asthma in Arizona's youth is more prevalent than the national average as it affects 10.2% of the pediatric population, compared to the national average of 9.2% and miss almost 2.5 times more school days than their peers without asthma nationally (Arizona Department of Health Services, 2016). Research has also indicated that 1 in 5 Hispanic patients with asthma are unable to afford their medications and are more likely to visit the Emergency Department for asthma, which is especially important in Phoenix given the large Hispanic population (Arizona Department of Health Services, 2016). The site of implementation is also an Accountable Care Organization and a majority of the patient population will have Medicare and Medicaid services and are likely to be an underserved population. Hispanic populations and low income populations experience more complications due to asthma, which supports the need for evidence based asthma management within this health care system (Cabana et al., 2014). It is likely that pediatric providers within a large health care system in Arizona manage a higher population of pediatric asthma patients and the patient population would likely benefit from provider asthma education and the implementation of evidence based practice guidelines.

Problem Statement

The pathophysiologic effects of asthma lead to narrowing of the airway as a result of edema, infiltration of the bronchi by inflammatory cells, secretion of mucous, bronchial smooth muscle constriction, and increased vascularity of airway epithelia (Ozge, 2016). The anatomical structure of the airways and lungs in young children are not fully developed, which contributes to the potential harm of asthma and can cause significant symptoms which contribute to the severity

of the disease. This constant inflammatory process occurring in the airways can lead to irreversible changes in the airway, known as remodeling, causing decreased airflow and overall decreased lung function. Research has demonstrated the long term consequences of childhood asthma with recent evidence showing children with an onset of asthma at 3 years of age demonstrate irreversible airway changes by 6 years of age as well as the ability to predict adult lung function based upon the severity of childhood asthma (Szefler et al., 2014).

The pediatric primary care provider is often responsible for managing asthma patients, therefore, it is crucial that primary providers are able to adequately diagnosis, treat, and manage patients with asthma. Although asthma is a chronic disease in both children and adults, children age 0-4 years average 117.2 provider office visits annually per 100 asthma patients, the highest of all age groups, followed by children age 5-14 years who averaged approximately 60 visits per 100 asthma patients annually (CDC, 2012). Children aged 0-4 were also the most likely to be hospitalized due to asthma (CDC, 2012). In addition to negative health consequences, asthma is very costly to society as a whole as asthma care cost estimates reach upwards of $56 billion USD annually and cause nearly 10.5 million missed school days per year (Asthma and Allergy Foundation of America, 2017).

Pediatric patients require a significant amount of management to avoid outcomes such as frequent PCP visits, missed school days, or hospitalization, and as a population, could see significant health benefits with the implementation of a clinical guideline to guide treatment and management decisions. In 2007, the National Heart, Lung, and Blood Institute, or NHLBI, released the Guidelines for the Diagnosis and Management of Asthma (ERP-3), which are considered the gold standard of asthma management and are utilized in health care institutions across the country to guide management of asthma. According to the NHLBI, the goals of

asthma treatment are to reduce impairment and risks associated with asthma by focusing on maintaining normal lung function, reducing the frequency of hospitalizations, and preventing exacerbations in patients with asthma (NHLBI, 2007).

The cumulation of this research leads to the PICOT question; in the pediatric population with asthma, does the implementation of evidence-based clinical guidelines versus lack of guidelines lead to better patient outcomes?

Search Process

Three databases were utilized during this literature search, including PubMed, CINALH, and The Cochrane Library. All search results were ultimately limited to only include research published within the last five years, however, there were several research articles included in the literature review that are older than five years. The significance of this older research is paramount to the pediatric asthma field and therefore could not be left out of this literature search.

PubMed

PubMed had a wealth of information regarding the NHLBI Pediatric Asthma Guidelines. Search terms including “NHLBI”, “asthma”, and “pediatric” yielded a total of 1,396 studies. These results were further narrowed to only include research published within the last five years and to only include randomized controlled trial (RCT), systematic reviews (SR), clinical trials, and reviews, yielding 172 studies, 46 of which were RCTs and 23 were SR. These articles were individually reviewed to determine the relevance to this project.

CINHAL

To perform a literature search within CINHAL, the terms “pediatric”, “guideline”, and “implementation” limited to publish dates within the last five years produced 15 results.

The Cochrane Library

A literature search within The Cochrane Library used terms “pediatric”, “guideline”, and “implementation” which produced 15 articles. See Appendix D-E for the search strategy.

After an extensive literature search and review, almost 35 relevant studies were found, however, after further investigation, a total of 10 studies were found to be the most applicable to the PICOT question posed in this DNP project.

Evidence Synthesis

Because asthma is one of the most common chronic pediatric conditions, it is an area of extensive research in the primary care setting to determine the most effective methodologies to decrease negative patient outcomes and the health care system burden associated with asthma. Because of the abundance of evidence available pertaining to pediatric asthma guideline and practice changes associated with better patient outcomes, the quality and strength of the evidence was quite strong. Two studies were level I systematic reviews, three were level II randomized control trials, four were level III consisting of experimental and quasi experimental studies, and one was a level IV study. A total of eight studies have explored the outcomes of implementing a national asthma guideline into a primary care practice, seven of which specifically involved the NHLBI guidelines, and reported similar results. While there was no stated bias in any study, two studies were funded by the NHLBI which could be considered a bias.

It was difficult to assess the validity and reliability of instrumentation as there was not consistent use of instrumentation and most studies relied on chart reviews to assess outcomes. There were several instruments used in individual studies, including Childhood Asthma Questionnaire, Paediatric Caregiver’s QOL Questionnaire, the Caregiver Questionnaire, and the Asthma Health Questionnaire, all of which have demonstrated validity and reliability (Sulaiman

et al., 2010; To, Cicutto, Degani, McLimont, & Beyene, 2008). Two studies utilized Likert scales and questionnaires developed specifically for the study and did not assess validity or reliability, which is a limitation for these studies.

The sample populations varied greatly among studies and were mostly homogeneous with research conduction specifically within the pediatric population. Two studies were heterogeneous as they explored pediatric and adult populations and one systematic review included pediatric and adult participants. All research took place in the United States except one which took place in Canada.

The measurements in these studies were similar across studies and closely aligned with key points established by the NHLBI including assessment of severity and control, appropriate medication prescriptions based upon severity, and possession of current Asthma Action Plan (AAP). In general, asthma guideline implementation lead to increased prescription of appropriate medications for level of severity, decreased emergency department visits, decreased severity of symptoms and increased quality of life.

Some of the evidence specifically pertaining to the NHLBI asthma guidelines discusses issues with provider non adherence to guidelines. As a result, there has been a large body of evidence recently published to better determine provider barriers to guideline adherence which include lack of experience or comfort educating patients, lack of time, lack of belief that guidelines will have a positive effect on patient outcomes, and lack of staff (Wall-Haas, 2012). The more successful studies involving guideline implementation encompassed some degree of provider education, ranging from in person education classes and online modules to education aimed to improve communication, which seemed to have a substantial impact on outcomes and encouraged provider adherence. Studies included in this literature search that integrated

guideline implementation with provider education had a larger number of outcomes affected compared to those focused on either guideline implementation or provider education, which supports the need to include provider education when implementing guidelines to ensure a significant influence resulting from the practice change. It appears that most recent research regarding pediatric asthma and the NHLBI guideline focuses on implementing the PACE program, which is an education and communication based, provider directed program based on NHLBI guidelines to improve outcomes by improving patient and provider interaction during asthma visits. While the PACE intervention was not specifically addressed in this DNP project, educational sessions with providers and staff to familiarize the staff with the NHLBI will be conducted.

A general lack of understanding of an asthma diagnosis by a patient and their family is a multifactorial issue and leads to increased health care utilization and decreased patient outcomes (Wall-Haas, 2012). In order to address this lack of understanding, Wall-Haas (2012) implemented the Shared Medical Appointment (SMA) intervention, a group based asthma education program based on NHLBI guidelines for affected patients and families delivered by a Pediatric Nurse Practitioner and a Behaviorist, which showed positive findings in patient outcomes in all ten measures, including decreased emergency department visits and decreased need for steroid use in asthma exacerbations. McCarty (2012) developed an asthma education class based on NHLBI guidelines delivered to parents of children with a current inpatient hospitalization due to asthma exacerbations or complications at Boston Children's Hospital and found that 93% of parents reported learning new information, demonstrating a need for earlier intervention and education to prevent asthma related hospitalizations.

Mold et al., (2014) explored the effect of implementation of NHLBI guidelines into

primary practices with the assistance of either a Practice Facilitator (PF) or a Local Learning Collaborative (LLC) to individualize implementation processes. Results found that the use of either a PF or an LLC or both lead to significantly higher documentation of asthma severity and a significantly higher amount of controller medication prescriptions for those patients with persistent asthma (Mold et al., 2014). This demonstrates that individualization of practice changes utilizing a lead person can lead to significant changes in patient outcomes. While this DNP project does not plan to utilize a PF or LLC, practices have established a provider lead in addition to the Asthma taskforce team to individualize implementation and practice flow changes to improve adherence and outcomes.

Several studies address the use of decision support tools to aid the provider in the recognition, diagnosis, or management of patients with asthma by implementing either paper or computer based interventions. A systematic review by Okelo et al., (2013) explored interventions aimed at improving heath care provider's adherence to the NHLBI asthma guidelines and found that interventions involving decision support, clinical pharmacy support, and feedback and audit were the most successful in providing statistically significant outcomes. Decision support in this systematic review included paper or computerized evidence based interventions that aid providers in the management of patients with asthma and were shown to decrease the number of emergency department visits, increase self education and possession of an AAP and to increase the incidence of controller medication prescription when this intervention was applied in the primary care setting (Okelo et al., 2013). Dexheimer et al. (2014) found that computerized implementation methods were associated with the highest number of success factors in a systematic review of 104 studies that exclusively examined asthma guideline implementation.

In addition to the possible benefits to patient care, Grant et al., (2010) also demonstrated considerable cost savings associated with appropriate asthma management, which will likely become a driving force in the health care system in the near future.

Purpose Statement

Asthma is a chronic illness that often presents in childhood and persists into adulthood, therefore, timely recognition of asthma and correct, evidence-based treatment based upon severity of symptoms is critical to preventing long term complications due to poorly managed asthma. Given the significance of this problem, the purpose of this implementation project is to determine the impact on patient outcomes that can be attributed to the implementation of the NHLBI asthma guidelines into practice at a pediatric primary care site.

Theoretical Framework

Johnson's Behavior System Model states that each patient has a specific behavioral system compromised of patterned, purposeful, and repetitive acts. As health care providers, it is essential to assist the patient in modifying their behaviors to maintain their health status while preserving their individualism while experiencing a decline in health or after receiving a chronic diagnosis. Because asthma is a diagnosis of chronicity, it is essential that the patient and provider devise a way to integrate asthma care into the patient's established behavior system. At times, this will require assisting the patient to achieve a balance between behaviors that support a healthy lifestyle while preserving their behavioral system as much as possible. As a pediatric provider, one must take development into consideration while providing education and incorporate developmental appropriate care into the visit. The relevance of this model to this project is especially evident when considering the outcomes, most of which are related to life factors which have an effect on asthma, including annual influenza vaccines, current AAP, and

annual assessment of asthma using an ACT.

Evidence Based Practice Model

The evidence-based model that is most appropriately utilized during implementation of this project is the Iowa Model of Evidence-Based Practice to Promote Quality Care. The Iowa Model identifies two sources of triggers, either a Problem Focused Trigger, which typically originates from a clinical problem or benchmarking data, or from a Knowledge Focused Trigger, which includes newly published research or standards of care, which in turn, prompt a practice or process change within a health care system (Reavy, 2016). This project was identified as a lack of consistent asthma care was identified in the practice while an evidence-based guidelines had been published several years previously, so in this case, the trigger was both Problem Focused and Knowledge Focused, however, this implementation most closely follows the Knowledge Focused Trigger arm of the model. This topic was identified as a priority because of the high incidence of pediatric asthma, almost 8.6% of pediatric patients have asthma, and because the implementation setting is a pediatric primary care clinic which encounters a large number of pediatric asthma patients (CDC, 2017). In 2007, the NHLBI released the EPR-3 Asthma Guidelines which are now considered the gold standard of pediatric asthma management and implementation at the site was necessary to create a consistency in asthma management and to improve patient outcomes. The project continued to develop while adhering to the Iowa Model as a team was formed and a thorough literature search revealed sufficient evidence and similar implementation projects confirmed overall improved patient outcomes after implementation of asthma guidelines (Reavy, 2016). The practice change was then designed and the necessary education and job aide materials were developed. Sustainability will be achieved by the project champion at the implementation site through continuing education sessions with staff and with

residents. In the final phase of the project, results will be disseminated to clinic staff members and DNP faculty at Arizona State University College of Nursing and Health Innovation.

Project Methods

Ethics

IRB approval was obtained from the Arizona State University IRB Board in April, 2017, prior to any data collection. During the check in process at the project site, a patient's parents or guardians sign a HIPAA form and a privacy policy that includes the allowance of de-identified data extraction from the EHR for research purposes. These forms are both routinely signed during the check in process, regardless of participation in this project or other research. In order to ensure protection of participants in this study, all data was collected by the IT department using AIMS, a software used to extract data from EHR, and de-identified prior to release to non staff members of the project team. CITI training for human participants was also completed by ASU research team members to obtain education regarding conducting ethical research.

There was no proposed budget or expected expenses that was required to complete this project as it was a practice change implemented by staff members at the project setting and DNP students.

Setting

The project took place in a large pediatric primary care clinic in a large, metropolitan city in the Southwestern United States. The clinic is part of a larger health care system and is a teaching facility with pediatric medical residents rotating through the clinic on a monthly basis, as well as continuity residents that spend more time completing residency at the clinic. The setting is also an Accountable Care Organization and therefore, a majority of the patient population have ACCCHS, or Arizona Health Care Cost Containment System, the state funded

Medicaid plan. The clinic consists of eight Physicians, ten continuity residents, two residents who rotate on a monthly basis, two nurses, seven medical assistants, and three front office staff who were involved in various aspects of this project.

Participants

Participants were recruited using convenience sampling as all participants are patients at the project setting site. Participant inclusion criteria included pediatric patients ages 5 to 18 years with a history of asthma, recurrent albuterol use, or episodic symptoms of airflow obstruction. Exclusion criteria are patients less than 5 years or greater than 18 years old or the presence of other co-morbid conditions which could affect the typical presentation and management of asthma, including but not limited to: chronic lung disease, interstitial lung disease, cystic fibrosis, congenital heart disease, bronchiolitis, croup or stridor, aspiration, tracheostomy dependence, and neurological disorders.

The project group consisted of the Physician Pediatric Department Head at the implementation site, a Performance Excellence Consultant, two ASU DNP students, faculty from ASU who served as the mentor to the project, and various members of the IT department within the site.

Procedure

The proposed intervention consisted of implementing a practice change to incorporate the NHLBI ERP-3 Asthma Guidelines into practice to standardize asthma management within the clinic and to improve asthma patient's management and outcomes. In order to facilitate a successful practice change, multiple documentation forms and staff education materials were created and stored in the Asthma Toolkit, which was made available to all staff members at the project site accessible through the intranet and members of the implementation group. An

Asthma Provider Note was created and input into the EHR in order to standardize the charting among providers and contained all nine metrics that are being measured to assess the practice change. All existing asthma note templates were removed from the EHR to encourage use of the newly created standardized assessment and management note. An Asthma Intake Form was created to be distributed to asthma patients prior to the visit to better assess the patient's asthma severity, symptoms, and management in order to allow for less asthma assessment and more patient and family education and engagement during the visit. A PowerPoint presentation was created to educate staff members regarding the current standard of asthma management within the clinic, the NHLBI ERP-3 Asthma Guidelines, and the practice change. In addition to the PowerPoint presentation, a number of education based tools were created to be used during the practice change process that were made available in the Asthma Toolkit. Materials included a number of Lesson Sheets which contained information regarding diagnosing asthma severity level, accessing and using the Asthma Provider Note within the EHR, and identifying asthma patients prior to the visit. The Lesson Sheets were used as the main tool to communicate information to those all staff members involved in the practice change and explained each aspect of the practice change in a format that could be used to quickly relay the pertinent information and reduce the expected delays caused with implementation of a practice change. Copies of the NHLBI ERP-3 Asthma Guidelines were printed and copies were distributed to the providers and made available at central locations within the clinic.

The practice change would include the identification of asthma patients by the medical assistants the day prior to the visit, who would then prepare paperwork to be distributed by the front office staff to patients with asthma. The day of the visit, the front office staff distributed the Asthma Intake Form and an ACT along with the typical forms provided during check in. Patients

and families would complete the Asthma Intake Form and ACT and give the forms to the medical assistant while the patient is being roomed, who would then give the completed forms to the provider to review prior to the visit. The providers would then use the Asthma Provider Note to document the visit, which would allow more time would be available to address patient and family education or to address management issues, improving the overall effectiveness of the visit.

One education session was conducted with the pediatric clinic staff members, immediately prior to the practice change implementation, which consisted of a PowerPoint presentation delivered by the Physician Pediatric Department Head and project group member. This session was attended by all providers, nurses, medical assistants, and front office staff and included time for questions, comments, and feedback from staff members. The same education session was also conducted with the resident group who would be rotating monthly through the clinic immediately prior to the implementation.

Outcome Measures

The outcomes measured in this implementation project are consistent with those measured by the NHLBI Asthma guidelines and other NHLBI Asthma guideline implementation projects. There are nine total outcomes being monitored, which include: number of asthma patients in each severity category, percentage of patient with spirometry testing preformed, number of PCP asthma related visits within the last 12 months, percentage of patients in the persistent category with a controller medication prescription, percentage of patient with a documented ACT, percentage of patients with a documented annual influenza vaccine, percentage with a documented meaningful use tobacco screen preformed, percentage of patients with an ACT score greater than 19, and the percentage of patients with persistent asthma with an

AAP. These outcomes are appropriate to the project and demonstrate salience, objectivity, and common currency, which are essential to ensure accurate and valid assessment of the implementation by using the selected outcomes (Kleinpell, 2013). All outcomes demonstrate salience as they are the same or very similar to the outcomes measured in most research associated with the implementation of the NHLBI guidelines and are included in the EPR-3 guidelines themselves. Because the guidelines focus on the management of asthma which takes place in a primary setting and the project is being implemented in a primary care setting, the outcomes have common currency. Demonstrating objectivity of the outcomes is also being accomplished through clearly and specifically defining the measures and identifying the most appropriate way to measure the outcomes.

Data Collection and Analysis Plan

Data was collected from the EHR by the clinic's IT department using AIMS, a software utilized by the clinic to extract data from the EHR, during the 6 month pre implementation period, and at three and six months' post implementation. Data was then de-identified and distributed to DNP students and other non-staff members of the group.

IBM SPSS Statistics version 23 was used to store, manage, and analyze all data. Descriptive statistics were used to describe the sample and the outcome variables. To analyze data, nonparametric inferential statistics were utilized. A Friedman ANOVA is a non-parametric test that is similar to a repeated-measures ANOVA, however, a Friedman ANOVA is used when the data does not meet the assumptions for a repeated-measures ANOVA (Kellar & Kelvin, 2013). The Friedman's ANOVA is used to determine whether differences in distributions of three or more dependent groups (Kellar & Kelvin, 2013). A two-tailed t test was also used in data analysis and the critical value was set at $p < .05$. Data was not analyzed and reported if there

was more than 50% missing data.

Project Results

Demographics

Group One. Group one consisted of 114 participants with the average age of 11.8 years (SD = 3.93) ranging 5-18 years. Participants averaged 1.02 appointments a year (n = 114, SD = 0.13), ranging from 1 to 2 appointments per year.

Group 2. Group two consisted of 76 participants with the average age of 12.6 years (SD = 4) ranging 5-18 years. Participants averaged 1.4 appointments a year (n = 76, SD = 0.75), ranging from 1 to 4 appointments per year.

Group 3. Group three consisted of 100 participants with the average age of 11.9 years (SD = 3.84), ranging from 5-18 years. Participants averaged 1.8 appointments a year (n = 100, SD = 1.22), ranging from 1 to 5 appointments per year.

See table 1 and 2 for addition demographic information.

Table 1

Percentage of Asthma Severity by Group

		Severity Level				
Group	n	Intermittent	Persistent	Mild	Moderate	Severe
1	114	27.2%	33.3%	39.5%	19.3%	1.8%
2	76	28.9%	50%	43.4%	31.6%	2.6%
3	100	30%	31%	40%	17%	1%

Note. Patient's asthma severity diagnosis will be either intermittent or persistent and either mild, moderate, or severe, which explains why the percentage totals of asthma severity by group do not equal 100%.

Table 2

Completion of Outcome Variables by Group

Group	n	AAP	ACT	Spirometry	Controller Medication	Influenza Immunization	MU Tobacco Screening
1	114	15.8%	14%	6.1%	86.8%	11.4%	78.1%
2	76	26.3%	28%	6.6%	89.5%	14.5%	77.1%
3	100	33%	36%	13%	100%	34%	69.2%

Data Analysis

A Friedman ANOVA was conducted comparing the outcome variables six months prior to the practice change, at three months post implementation, and at six months post implementation. A significant difference was found ($\chi 2(15) = 216.62$, $p < .05$). The implementation of the practice change significantly affected the outcome variables.

Discussion

Impact

Patient. When comparing pre and post implementation measures, there is a clear increase in a majority of the outcome measures in the post implementation data, which is indicative of the patients receiving evidence based management of asthma. In Groups 2 and 3, more patients had an AAP which are used by parents and schools during illnesses and exacerbations to guide treatment. An AAP assists parents in determining when to seek medical treatment and when to manage asthma at home, reducing the amount of PCP visits and hospital visits. The completion of an ACT also increased in Groups 2 and 3, which indicates a more accurate and evidence based

assessment of the patient's asthma control within the last four weeks. The ACT is a useful tool to determine whether the patient's asthma requires more treatment than the patient is currently receiving, as well as determining the patient and parent's understanding of the disease process and appropriate management. Patient's with persistent asthma were more likely to be prescribed a controller medication in Group 2 and 3 compared to Group 1, which is the appropriate medical management of persistent asthma according to the NHLBI ERP-3 Asthma Guidelines. Spirometry is a useful tool in assessment the lung capacity of asthma patients and was greatly increased in Group 3, compared to patients in Groups 1 and 2. Patients in Groups 2 and 3 were also more likely to have received an influenza immunization than patients in Group 1, however, this could be attributed to the timing of data collection and the degree of influenza in the community between seasons.

Provider. An increase in the outcome variables at the three points of data extraction suggests provider compliance with the practice change and increased knowledge of appropriate management of pediatric asthma. It is also important to note the increasing completion of the outcome variables when comparing Group 2 and 3 which suggests providers are complying with the practice change and integrating the NHLBI ERP-3 Asthma Guidelines into practice over time.

System. One of the outcomes variable, Tobacco Use Meaningful Use, is a mandatory requirement with the health care system to assess during all patient visits to receive funding through the Medicare and Medicaid EHR Incentive Program. There was a decrease in completion of this measure since when comparing the three groups, which the health care system can utilize when attempting to identify barriers to completing this mandatory assessment. This project was designed with future plans to implement at other sites within the health care clinic

depending on the outcomes of the project, which will likely have similar affects on the outcome measures.

Consistently with Literature

The findings of the project are consistent with the literature showing the implementation of evidence based guidelines asthma guidelines resulted in positive changes in the outcome variables, as was expected during the development of the project. Multiple studies cited an increase in the appropriate prescription of controller medications for patients with persistent asthma and increased possession of an Asthma Action Plan with guideline implementation and provider education, both of which were increased in this study. A number of studies in the literature specifically implemented the NHLBI ERP-3 Asthma Guidelines and created provider education materials, much like this study, and reported similar results.

Studies which included interventions to increase patient and family knowledge of asthma showed increases in similar outcome variables, and while patient and family education as not specifically addressed in this practice change, streamlining the asthma visits as a result of the practice change likely allowed for more patient and family education during visits.

Sustainability

The project will be sustained by the Physician Pediatric Department Head who identified the need for the project, designed the practice change, and worked to implement the project. At this point, the practice change was implemented 11 months ago and data continues to support the compliance to the practice change. In order to maintain compliance with the project, additional education sessions will be required to keep staff members updated on the practice change and new staff members will require education upon hiring. Education sessions with new groups of residents will also be necessary, at least on an annual basis. The education materials in the

Asthma Toolkit should also remain accessible to staff members to use as resources as necessary. In order to continue to assess the outcomes of the practice change, a reliable form of data reporting will be necessary to establish, as this was a major limitation encountered in the project.

Strengths and Limitations

The greatest strength of this project is that asthma is one of the most common, chronic childhood diseases and therefore, has a wealth of literature available regarding the treatment and management of pediatric asthma, as well as different approaches to enhance the effectiveness of provider education. In addition, the commonality of asthma provided an opportunity to affect the health outcomes of a significant portion of the patient population at the project site with the implementation of a single practice change project. A major strength of this project was the documented success of the NHLBI ERP-3 Asthma Guidelines that can be found in the literature, since the guidelines were released in 2007.

Several limitations were identified during the implementation and practice change, most notably regarding follow up education sessions with staff members, newly hired staff, and residents that would be rotating through the clinic on a monthly basis. While a wealth of information was created and dissemination to staff regarding the NHLBI ERP-3 Asthma Guidelines and the practice change, only one education session was conducted, which most likely contributed to less compliance as new staff are hired or information provided during the education session is forgotten. There was some degree of push back from staff noted during the education sessions, most likely attributed to a resistance to practice change. There was also difficulty extracting data throughout the entirety of the project which lead to a significant number of patient visits being excluded from the data analysis due to missing data. The implementation group experienced difficulty creating reports from raw data, due to a lack of staff knowledge

using the AIMS system to extract data and limitations of staff availability in the IT department. As this project continues to progress, the ability to extract different types of data, including hospitalizations and emergency department visits related to asthma and ACT scores would be useful when continuing to develop and disseminate this project to other clinics within the health care system.

Conclusion

In general, the implementation of a practice change to use evidence based NHLBI ERP-3 Asthma Guidelines, along with staff and provider education sessions and creation of standardized assessment and documentation tools resulted in positive changes in the outcomes variables. Findings from this study along with the literature of implementing evidence based asthma guidelines supports similar practice change implementations in other pediatric primary care clinics.

References

Arizona Department of Health Services. (2016). *The 2016 arizona asthma burden report.* Retrieved from http://www.azdhs.gov/documents/prevention/tobacco-chronic-disease/az-asthma-burden-report.pdf

Asthma and Allergy Foundation of America. (2017). *Cost of asthma on society.* Retrieved from http://www.aafa.org/page/cost-of-asthma-on-society.aspx

Cabana, M.D., Slish, K.K., Evans, D., Mellins, R.B., Brown, R.W., Lin, X., Kaciroti, N., & Clark, N.M. (2014). Impact of Physician asthma care education on patient outcomes. *Health Education & Behavior, 41(5),* 509-517. doi: 10.1177/1090198114547510

CDC. (2012). *National survey of asthma: United states, 2001-2010.* (DHHS Publication No. [PHS] 2013-1419). Retrieved from https://www.cdc.gov/nchs/data/series/sr_03/sr03_035.pdf

CDC. (2017). *FastStats Asthma*. Retrieved from https://www.cdc.gov/nchs/fastats/asthma.htm

Dexheimer, J. W., Borycki, E. M., Chiu, K., Johnson, K. B., & Aronsky, D. (2014). A systematic review of the implementation and impact of asthma protocols. *BMC Medical Informatics and Decision Making, 14(82),* 82. doi: 10.1186/1472-6947-14-82

Grant, R., Bowen, S. K., Neidell, M., Prinz, T., & Redlener, I. E. (2010). Health care savings attributable to integrating guidelines-based asthma care in the pediatric medical home. *Journal of Health Care for the Poor and Underserved, 21(2),* 82.

Holaday, B. (2017). *Behavioral system model.* Retrieved from http://nursekey.com/behavioral-system-model/

Johnstone, L., Spence, D., & Koziol-McLain, J. (2010). Oral hygiene care in the pediatric intensive care unit: practice recommendations. *Pediatrics, 36(2),* 85-97.

Kellar, S.P., & Kelvin, E.A. (2013). *Munro's statistical methods for health care research (6th ed.).* Philadelphia, PA: Wolters Kluwer Health.

Kleinpell, R.M. (2013). *Outcomes assessment in advanced practice nursing (3rd ed.).* New York: Springer Publishing Company.

McCarty, K., & Rogers, J. (2012). Inpatient asthma education. *Pediatric Nursing, 38(5),* 257-263.

Mold, J.W., Fox, C., Wisniewski, A., Lipman, P.D., Drauss, M.R., Harris, D.R., Aspy, C., Cohen, R.A., Elward, K., Frame, P., Yawn, B.P., Solberg, L.I., & Gonin, R. (2014). Implementing asthma guidelines using practice facilitations and local learning collaboratives: A randomized controlled trial. *Annals of Family Medicine, 12(3),* 233-240. doi: 10.1370/afm.1624.

NHLBI. (2007). *Guidelines for the diagnosis and management of asthma (ERP-3).* Retrieved from https://www.nhlbi.nih.gov/files/docs/guidelines/asthgdln.pdf

Okelo, S.O., Butz, A.M., Sharma, R., Diette, G.B., Pitts, S.I., King, T.M., Linn, S.T., Reuben, M., Chelladurai, Y., & Robinson, K.A. (2013). Interventions to modify health care provider adherence to asthma guidelines: a systematic review. *Pediatrics, 132(3),* 517-534. doi: 10.1542/peds.2013-0779

Ozge, Y. (2016). Where does current and future pediatric asthma treatment stand? Remodeling and inflammation: Bird's eye view. *Pediatric pulmonology, 51(12),* 1422-1429. doi: 10.1002/ppul.23488

Papadopoulos, N. G., et al. (2012). International consensus on (ICON) pediatric asthma. *European Journal of Allergy and Clinical Immunology, 67(8),* 967. doi: 10.1111/j.1398-9995.2012.02865.x

Radhkrishnan, D.K., Dell, S.D., Guttman, A., Shariff, S.Z., Lui, K. & To, T. (2014). Trends in the age of diagnosis of childhood asthma. *Journal of allergy and clinical immunology, 134(5),* 1057-1062. doi: 10.1016/j.jaci.2014.05.012

Reavy, K. (2016). *Inquiry and Leadership: a resource for the DNP project.* Philadelphia, PA: F.A. Davis Company.

Reddy, A.P., & Gupta, M.R. (2014). *Advances in experimental medicine and biology.* New York: Springer.

Szefler, S. J. (2015). Advances in pediatric asthma in 2014: Moving toward a population health perspective. *The Journal of Allergy and Clinical Immunology, 135(3),* 644-652. doi: 10.1016/j.jaci.2014.12.1921

Sulaiman, N.D., Barton, C.A., Liaw, S., Harris, C.A., Sawyer, S.M.., Abramson, M.J., Robertson, C., & Dharmage, S.C. (2010). Do small group workshops and locally adapted guidelines improve asthma patients' health outcomes? A cluster of randomized controlled trial. *Fam Pract, 27(3),* 246-254. doi: 10.1093/fampra/cmq013

To, T., Cicutto, L., Degani, N., McLimont, S., & Beyene, J. (2008). Can a community evidence-based asthma care program improve clinical outcomes? A longitudinal study. *Medical Care, 46(12),* 1257-1266. doi: 10.1097/MLR.0b013e31817d6990

Wall-Haas, C. L. (2012). An innovative approach to partnership in asthma care. *Journal of Asthma & Allergy Educators, 3*(4), 202-207. doi: 10.1177/2150129712442538