WHAT ARE THE BARRIERS TO DIAGNOSIS AND TREATMENT OF ASTHMA AMONG SCHOOL-AGE CHILDREN IN NORTHWESTERN PENNSYLVANIA?

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Abstract

Asthma affects nearly ten percent of Pennsylvania children. The national prevalence of asthma in school-age children is eight percent. Pennsylvania Department of Health (PADOH) reports a ten percent mortality and morbidity rate from asthma. In Pennsylvania, an estimated twenty-eight percent of children miss at least one day of school because of asthma. There is a known correlation between rural and low-income children and higher prevalence of asthma. There have been studies that evaluate provider usage of different national and world-wide asthma treatment regimens. Most of these studies indicate providers are aware of protocols but 32 to 70% of providers utilize parts of them. Several studies report other factors that cause barriers to asthma management include communication, beliefs about asthma amongst providers and caregivers/children, understanding medications, time (parents from work or provider re-imbursement), and lack of support from community or employer. This study evaluated barriers to diagnosing and management of asthma in school age children in Northwestern Pennsylvania utilizing a modification of the Physician Asthma Care Education (PACE) presentation and survey. The outcomes revealed improved confidence in Nurse Practitioners and Physician Assistant when compared to physicians after receiving an educational presentation. The greatest barriers found were medications and identifications of triggers/asthma management education for caretakers and / or children. Rural Health Clinic status and other demographic differences make

the outcomes difficult to validate due to the small sample size. The PACE survey does not specify diagnosing asthma clearly but does educate on teaching triggers and management.

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Chapter 1

Introduction

Background

Asthma affected more than 8% of children in the United States (Centers for Disease Prevention and Control [CDC], 2013). Asthma was consistently rated one of the most common chronic medical conditions in children from 2010 to 2013 (CDC, 2013). The U.S. Department of Health and Human Services defined asthma as "a common chronic airway disorder characterized by periods of reversible airflow obstruction" (Akinbami et al., 2012). The CDC (2013) estimated that children with asthma missed 13.8 million days of school, up from 12.4 million in 2003. In the state of Pennsylvania, 267,688 children have been diagnosed with asthma (CDC, 2013).

Nationally, and in Pennsylvania, there is a significant population of children with asthma. Almutawa, Al-Mutairy, Al-Arada, and Kamel (2013, p. 18) defined asthma as "chronic inflammatory disease characterized by hyperresponsive and hypersensivity affecting mainly the medium and small bronchi." The World Health Organization (WHO) estimated 235 million people had asthma in 2013. It also reported asthma as the most prevalent non-communicable disease among children (WHO, 2013). The estimated cost of asthma in the United States in 2014 was $19.7 billion (Trent, Zimbro, & Rutledge, 2014). Asthma is not curable. Identifying and treating children early in the disease process can help decrease mortality rates and the number of missed days of school while increasing quality of life by controlling the severity of the disease (CDC, 2013; National Heart, Lung, and Blood Institute, 2007).

The CDC (2013) reported that Pennsylvania's largest age group of asthmatic children are 15 to 17 years old. This age group accounts for 14% of the reported cases of asthma in Pennsylvania, which is 4% higher than 38 other states (CDC, 2013). The Pennsylvania

Department of Health (PADOH) reported that "ages 12–17 had a higher current asthma prevalence (11.7 percent) compared to children ages 0–11 (10.0 percent)" in 2011 to 2013 (2016, p. 5). The prevalence in boys was 4% higher than in girls (11.8% versus 7.8%) (CDC, 2013). In 2013, Pennsylvania's 3-year prevalence was 10.2%, compared to 8.9% for the entire United States. The lifelong prevalence for boys in Pennsylvania was 17.5%, compared to 16% for the United States. Girls had an 11% prevalence of asthma in Pennsylvania, compared to 11.6% in the United States (PADOH, 2015, pp. 30 & 32). Early juvenile boys' prevalence decreases as girls' increases, becoming identical by ages 14–17 (Akinbami et al., 2012). The median age for the diagnosis of asthma was 4.9 years old (Wendt, Symanski, & Du, 2012). The PADOH (2015) also reported that, in their health districts for 2013, northwestern Pennsylvania had a 7% self-reported asthma rate: 8% of males and 6% of females for ages birth to 11 years old (7%) and ages 12 to 17 (8%). Multi-race non-Hispanic populations and Black non-Hispanics had the highest prevalence for race (CDC, 2013). Akinbami et al. (2012) reported the national prevalence in 2012: Black 11.1%, White 7.8%, Asian 5.3%, and Puerto Rican 16.6%. In Pennsylvania in 2013, 23.7% of the 269,432 children with asthma were Black non-Hispanics—a rate two times higher than non-Hispanic Whites (PADOH, 2015).

Akinbami et al. (2012) estimated that 6.7 million children in 2007 went to their primary care provider (PCP) for asthma; there were also 640,000 emergency room visits and 456,000 hospitalizations nationally for children with asthma. Deaths from asthma for all ages were highest among Blacks (31.5%), but the number of children who died from asthma is not considered "stable" (CDC, 2013, p. 2). Akinbami et al. (2012) reported 3,262 deaths from asthma, of which 185 were children. The PADOH (2015, p. 1) reported that, "in 2012, of the 145 deaths due to asthma, 51 were males and 94 were females." It did not differentiate the number of

deaths into age groups. The data equated to 1 death per 100,000 people that year (PADOH, 2015).

The PADOH (2016) reported that, in 2013, 269,432 children were reported to have asthma, with 11.9% having been diagnosed with asthma. In 2013, an "estimated 28% of school age children missed some days of school due to asthma" (PADOH, 2016, p. 1). Akinbami et al. (2012) found that, nationally, 55% of children with asthma report limitations in activities. There were 10.5 million missed days of school, with 60% missing at least one day for asthma (Akinbami et al., 2012, p. 4).

Wendt et al. (2012) described a higher prevalence of asthma in rural areas in the United States among the Medicaid population. In their study in rural Texas, these authors found a higher incidence of smoking in households with asthmatic children. Akinbami et al. (2012) found an 8.7% prevalence of asthma in nonmetropolitan areas of the United States, compared to 9.3% in northwestern Pennsylvania. Of the 67 counties in Pennsylvania, 48 are considered rural (PADOH, 2016). The Center for Rural Pennsylvania defined *rural* based on population density:

> Population density is calculated by dividing the total population of a specific area by the total number of square land miles of that area. According to the 2010 Census, the population of Pennsylvania is 12,702,379 and the number of square miles of land in Pennsylvania is 44,743. Therefore, the population density is 284 persons per square mile. (2014, para. 1)

There is a known correlation among low socio-economical level, increased asthma incidence, and poor health literacy (Wendt et al., 2012).

The population classification for the area of this study is considered rural and socioeconomically poor. According to the PADOH (2016), 80% of Pennsylvania is considered rural. The counties involved in this study are Jefferson, Forrest, Clearfield, and Elk. Of these, Jefferson, Clearfield, and Forest counties are among the 10 poorest in the state (PADOH, 2016).

The median household income for the state of Pennsylvania is $52,548 to $71,088, with the specific counties in this study reporting the following: Jefferson $41,262, Clearfield $41,030, and Forest $36,556 (PADOH, 2016). In 2013, 13.3% of the Pennsylvania population had incomes below the poverty level, with 9.2% being families; 5.3% did not have health insurance, 31.4 % were on public access insurance, and 73% had private insurance (PADOH, 2016). Only 94% of children are covered by insurance, even after the Affordable Care Act went into effect: 19.6% Medicare/Medicaid, 5.4% Pennsylvania's Children Health Insurance Program (CHIP), 59.5% parents' employer, and 4.7% uninsured (PADOH, 2016). Socioeconomic status may affect asthma diagnosis. For example, in Texas, low income children are disproportionately affected by asthma at a rate of 56% of all Texan children and are more likely to be diagnosed with asthma than the general population (Wendt et al., 2012). Pennsylvania's medical assistance wellness program for children, Early and Periodic Screening, Diagnosis, and Treatment (EPSDT), does not address screening for asthma; it only reviews if there is a history (Keystone First, n.d.). This is consistent with Wendt et al.'s (2012) study addressing how Medicaid does not require assessing for asthma, just documenting the history.

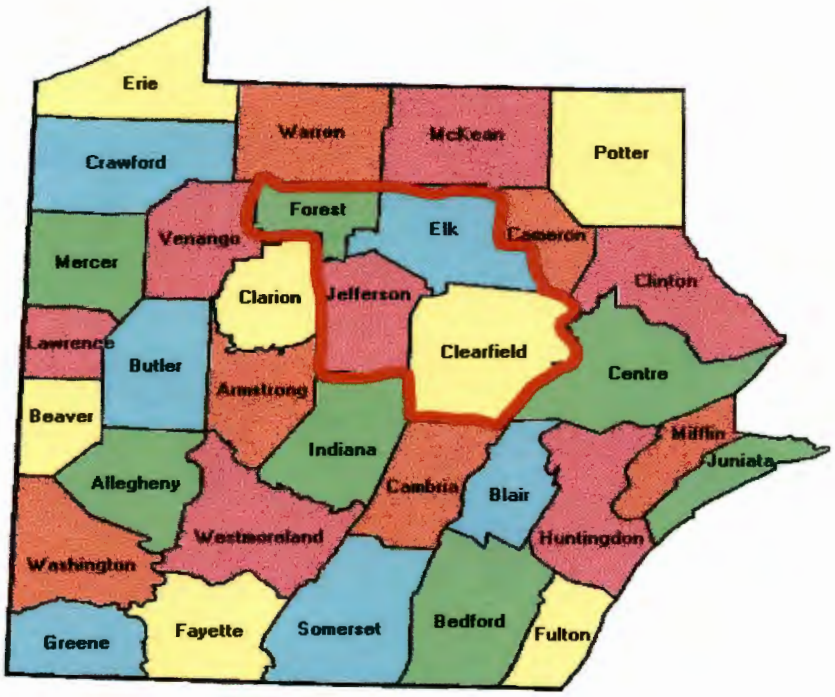

Figure 1. County map of western Pennsylvania. From: http://www.cohp.org/pa/images/pa_west.gif

Many providers are aware of the National Heart, Lung and Blood Institute (NHLBI), National Asthma Education and Prevention Program (NAEPP), also known as EPR-3, and Global Initiative in Asthma (GINA) guidelines, but few utilize them (Lee & Le, 2013) Almutawa et al.'s (2013) study revealed that 32% of physicians followed asthma guidelines. O'Laughlen, Rance, Rovnyak, Hollen, and Cabana (2013) conducted a comparison study of nurse practitioners, using a previous study by Cabana, Rand, Becher, and Rubin (2001). O'Laughlen et al. (2013) concluded that adherence to the guidelines was suboptimal for both types of providers, and 90% of the time the guidelines were not followed. Lee and Le (2013) found that 90% of PCPs knew about EPR-3 guidelines but only 71% were aware of what they entailed. Alotaibi (2012) came to a similar conclusion in his study in Saudi Arabia. Using the Saudi National

Asthma Protocol (SNAP), he found that 70% of physicians were aware of the guidelines but only 78% reported utilizing them.

What are the NAEPP or EPR-3 guidelines? The EPR-3 is the United States' guidelines used by the National Asthma Educators Certification Board. The National Institute of Health forms its templates for step therapy, the initiation of treatment, asthma action plans (AAP), and quantifying asthma based off the EPR-3, which covers how to diagnose asthma, when to use spirometry, long-term management of asthma, use of medications, patient education for self-management, and AAP. EPR-3 also discusses controlling environmental factors and comorbid conditions like obesity, GERD, obstructive sleep apnea (OSA), upper airway diseases, stress, and depression. The guidelines encourage the use of flu vaccines for those over the age of three. Finally, EPR-3 includes what to do for exercise-induced bronchospasm, pregnancy, and the management of exacerbations at home and emergently. EPR-3 has step approaches for managing asthma by age groups, common medications with their doses, and a patient education section for questions regarding inhaled corticosteroids (NHLBI, 2007).

Early intervention in recognizing and treating asthma has an impact on the disease progression and health costs (Friedman, 2010). Trent et al. (2014) stated that underdiagnosing and undertreating asthma increase the burden on children and their families by increasing morbidity and mortality, decreasing quality of life, and increasing absenteeism from work/school.

Purpose

The purpose of this quantitative study is to evaluate providers' perceived barriers in diagnosing and treating school-aged children with asthma by using pre- and post-surveys during an educational presentation. The participants will be licensed healthcare providers (physicians,

physician assistants, and nurse practitioners) who work in a local hospital system in northwestern Pennsylvania. This healthcare system will include four rural hospitals and their clinics. This project will look at provider barriers, patient and/or caregiver concerns and complaints during office visits, patient and/or caregiver understanding of medications, and collaboration between providers and school nurses.

Research Question/Hypothesis

The PICO question for this study is: What are the barriers to the diagnosis and treatment of asthma among school-age children in northwestern Pennsylvania? Understanding physicians', nurse practitioners', and physician assistants' perceived barriers to the EPR-3 guidelines will help develop a quality improvement project to meet these important standards of care. Providers have the knowledge to diagnose and treat asthma in school-age children, but fail to follow the national guidelines. Will providers' demographics make a difference in the outcomes? The answer to this question is still unknown, providing a (null) hypothesis.

Need for the Study

There is a discrepancy in knowing (compared to practicing) national guidelines for healthcare. The mortality and mobility rates are over 10% in the state of Pennsylvania (CDC, 2013). Bass (2016) said it best: "Poor control in childhood represents specific risk of morbidity when children transition to adulthood. Asthma not controlled in childhood can result in significant respiratory morbidity into adulthood" (p. 15).

As a nurse practitioner in rural northwestern Pennsylvania pulmonology practices, following the guidelines is difficult during appointment time constraints, even when that is the focus. It is the belief of this provider that identifying barriers in a rural Pennsylvania setting could help develop a quality improvement project.

Summary

The purpose of this project is to identify barriers in diagnosing and treating school-age children with asthma in a rural northwestern Pennsylvania health system. Asthma affects 8% of school-age children in the United States and has an approximate 10% prevalence rate in Pennsylvania (PADOH, 2016), which equates to an estimated 28% of missed school days due to asthma. The literature has shown that there are different barriers to following the EPR-3, such as a lack of awareness, a lack of resources, reimbursement, and time.

Chapter 2

Review of Related Literature

According to the PADOH (2015), more than 10% of Pennsylvania's school-age population was diagnosed with asthma in 2013. Children in rural and lower socioeconomic areas of the country tend to have a higher incidence of asthma (Wendt et al., 2012). Pennsylvania classifies 80% of its population as rural. The northwestern region of Pennsylvania has a 9.3% prevalence rate of asthma. The counties of this study, which are from the northwestern region of the state, are among the 10 poorest in Pennsylvania (PADOH, 2016). Barriers to asthma management have been identified at various levels, including Primary Care Providers, caregivers, and school nurses. The most common areas include time constraints, education on medication/disease, social issues, and communication. This chapter will review the outcomes of various surveys.

Problem Statement

The PADOH (2015) reported that 10.3% of children had been diagnosed with asthma in 2013, with 15- to 17-year-olds being the largest population (CDC, 2013). One out of 100,000 people in Pennsylvania die each year from asthma (PADOH, 2015). The PADOH (2016)

reported that 11.9% of children enrolled in school were diagnosed with asthma. Sixty percent of children in school will miss at least one day because of asthma (Akinbami et al., 2012). Children living in rural and poor socioeconomic areas are at a higher risk (Wendt et al., 2012). In 2016, the PADOH reported that 48 of the 68 counties in Pennsylvania are considered rural, equating to 80% of the state's population. The northwestern region of Pennsylvania has a 9.3% prevalence rate of asthma. The counties included in this study (see Figure 1) are among the 10 poorest in the state (PADOH, 2016). The PADOH (2016) reported that, in 2013, 13.2% of children with asthma experienced nighttime symptoms, 9.8% had Emergency Room visits, 36.2% had asthma attacks, 28% missed some days of school, 18.4% missed 1–5 days of school (the Healthy People 2020 standard is 48.8% missed school days), and 8.2% had moderate to severe activity intolerance. Finally, 93% of children self-reported symptom-free days, 1% had consistent symptoms, and 28.8% had at least one routine checkup in the last 12 months (PADOH, 2016).

Lee and Le (2013) reported that many providers are aware of EPR-3 and/or GINA guidelines, but do not use them. Ninety percent of Primary Care Providers (PCPs) reported knowing of the guidelines while only 71% responded to knowing the details. Studies from other countries also reported similar findings for the GINA or their national asthma guidelines. Almutawa et al. (2014) found that, in Kuwait, following the GINA guidelines was inadequate: 37% of PCPs in Kuwait follow published asthma recommendations. Kuwaiti PCPs reported workload, lack of spirometers, improper follow-up system from the Emergency Room, and patient compliance to be the top barriers (Almutawa et al., 2013). In Saudi Arabia, a study on their country's asthma protocol, the Saudi National Asthma Protocol (SNAP), found that 70% of the physicians were aware of the existing protocol and 78% utilized the protocol. The most

common barriers were a lack of awareness (25%), patient non-compliance, and a lack of resources (Alotaibi, 2012).

O'Laughlen et al. (2013) compared various studies (led by Dr. Michael Cabana) and found that nurse practitioners and physicians do not follow all the guidelines 90% of the time. No studies have focused on providers in Pennsylvania. In O'Laughlen et al.'s (2013), Cabana et al.'s (2001), and Alotaibi's (2012) studies, the most common barriers identified were a lack of awareness, patient noncompliance, a lack of resources (spirometry, peak flow meters, education material, support staff), a belief that the guidelines were not suitable, reimbursement, and a lack of time. Early intervention in recognizing and treating asthma has an impact on the disease progression and health costs (Friedman, 2010).

Molis, Bagniewski, Weaver, Jacobson, and Juhn (2008) examined the timeliness of diagnosing asthma. They found that delays in the treatment of asthma in children can affect children's morbidity, lung function, and quality of life. They further determined the predictors of timely diagnosis to be a likelihood of asthma (definite versus probable), family history, and type of symptoms at the time of index date (Molis et al., 2008). Molis et al. (2008) looked at 839 charts for asthma; 276 met the study criteria, and—of these—97 met the criteria for the diagnosis of asthma in a timely manner. The remainder of the participants (179) had a median 3.3-year delay in diagnosis. The children with Exercise Induced Wheezing or Bronchospasm were more likely to be given an asthma diagnosis in a timely manner versus those with a spasmodic cough. Timely manner is defined as less than a median delay of 1.4 to 3.3 years. Spasmodic cough was more likely diagnosed with upper respiratory infection-induced wheezing, wheezing, or bronchospasm. Moderate to severe asthma was more likely to be diagnosed than mild intermittent asthma (Molis et al., 2008). "Untimely diagnosis of asthma appears to occur

primarily in children and adolescents who lack the commonly recognized risk factors for asthma" (Molis et al., 2008, p. 1534).

Barriers to the timely treatment of asthma have been researched from the parental, provider, and school nurse perspectives. Trent et al. (2014) used the Asthma Barrier Questionnaire to identify the most common barriers from parents. The most common barriers were found to be split families, remembering to take medications, and support from the schools. The common barrier for parents was getting time off from work to help manage their child's asthma (Trent et al., 2014). Parents whose child had more controlled asthma had fewer barriers identified on the Asthma Barrier Questionnaire and scored higher on the Asthma Knowledge Test (Trent et al., 2014)

Young, Kanchanasuwan, Cox, Moreno, and Havican (2015) studied low income rural asthmatics barriers and how those barriers associated with asthma control in Texas; most barriers included knowledge and beliefs related to the use of asthma medications. The combination of self-efficacy and outcome expectancy influenced individual performance. Only participants with barriers related to beliefs had significantly worse asthma control. Recognizing barriers for individuals in adhering to medications requires considering patient-specific problems, then applying a solution to correct them (Young et al., 2015). The following barriers were identified: (1) knowledge barriers related to the misconception of a medication's purpose, administration techniques, medication doses, medication schedules, and duration of therapy; (2) belief barriers related to a decrease in self-efficacy about self-management of asthma, disbelief in benefit of medications, and fear of long-term effects of medications; and (3) practical barriers related to financial issues, a failure to remember to take medications, difficulty with many medications, and medications that are hard to tolerate (Young et al., 2015). In general, Young et al. (2015) felt

theirs was the first study to show barriers to asthma medication use associated with asthma outcomes.

Svavarsdottir et al. (2013) compared perceived barriers among school nurses in Iceland and Minnesota. An estimated 44% of students going to school do not notify the school nurse of problems with their asthma because of the feeling that uncontrolled asthma is normal for them (Svavarsdottir et al., 2013). The authors suspected that children with asthma are more likely to have their activities restricted and miss school, thereby affecting their academic performance and health-related quality of life. They confirmed this with their study. Children with uncontrolled asthma miss more school days (33%), refill Albuterol more often, and visit the ER more than children with controlled asthma. The difference was 5.53 days missed for uncontrolled asthma versus 1.84 with controlled asthma (Trent et al., 2012). Akinbami et al. (2012) confirmed these data by reporting that 58.7% of children with asthma miss one or more days of school and 5.5% have limitations in their activities because of asthma.

Barriers found by Svavarsdottir et al. (2013) were parental and community in nature. Parental barriers included difficult communication with parents regarding asthma management, lack of follow-up on school nurse referrals or being notified by the school nurse when a child is having problems, low literacy in English and health, and low socio-economic backgrounds. Community barriers included poverty, transportation, financial, and insurance issues. Crisis-oriented living is defined as handling a health issue as it arises; when the issues reaches a crisis point, the patient then deals with the economic fallout (Svavarsdottir et al., 2013). Poverty, increased prevalence of mental illness, single parenthood, and financial struggles were the most common theme in parents' ability to manage their child's asthma (Trent et al., 2014). Asthma

management for parents and children was influenced by transportation, office hours, health knowledge, and beliefs and negative expectations of care.

When Trent et al. (2014) examined barriers for healthcare providers, they found a lack of outcome expectancy and poor self-efficacy to be the most common. Garcia, Serban, Swann, and Fitzpatrick (2015) found an association between severe asthma outcomes and estimated geographic access to healthcare in school-age children. Improved outcomes to asthma occurred when there were shorter distances to healthcare and specialists, but this did not decrease the frequency of Emergency Room visits (Garcia et al., 2015).

Cabana et al. (2001) surveyed pediatricians' adherence to EPR-3 guidelines, generating a 55% response rate. Of the responders, 88% reported being aware of the guidelines, 81% reported having a copy available, but adherence was just 39% to 53%. The breadth of the adherence depended on the area of the guidelines being followed. One-half of the physicians reported a lack of time (for parts of the guidelines that involved extensive screening) and counseling to parents and/or patients. "Lack of familiarity for all guideline components was more prevalent than lack of overall guidelines awareness (12%)" (Cabana et al., 2001, p. 1059).

Young et al. (2015) found patient education and counseling to address knowledge barriers may help with management. Barriers in patient–provider communication about medication usage and the role medications play in asthma management lead to doubts of patients' ability to manage their medications. When the authors researched pharmacists in rural areas, they determined that patient barriers included knowledge (not understanding the purpose of medications, dosing, duration of medications, technique, and routine of taking medications), beliefs (low self-efficacy, uncertainty of benefits of medication, fear of long-term effects, and stigma of having asthma), and practical measures (financial, taking many different medications,

administration, and recall taking medications). Trent et al. (2014) agreed that this assessment demonstrated common barriers identified as family resources, access to healthcare services, cost, and following EPR-3 guidelines. They further recommended that Healthcare Providers (HCP) can provide opportunities for open communication to identify barriers in asthma management early in the disease and improve outcomes (Trent et al., 2014).

Harrington, Haven, Bailey, and Gerald (2013) also identified barriers to providers' asthma management based on caregivers' perceived health literacy. They found that communication with parents was based on perceived understanding of asthma treatment plans. Providers expressed that open communication, such as teach-back and simple teaching plans, may be indicated, but time constraints cause them to underutilize this tool. Communication between providers and patients/caregivers is essential in providing care for asthmatics, but it may not be recognized by providers. By increasing communication techniques, there is an increase in patient satisfaction, knowledge, and adherence to asthma management (Taylor-Fishwick, Okafor, & Fletcher, 2015).

Tumiel-Berhalter and Watkins (2006) evaluated provider knowledge and attitude toward asthma guidelines. Although their findings were published the year prior to the latest guidelines, the authors found fewer barriers identified in this project and a better outlook toward the guidelines. They concluded that "the findings of this study reinforce the attitude towards the guidelines are more strongly associated with self-reported regular use of the tools than knowledge" (p. 627). They did note that they could not compare trends to allied health providers, residents, or attending physicians.

O'Laughlen et al. (2013) found that 38% of physicians self-reported implementing peak flow meter instructions for patients. These same physicians stated that 43% screen/counsel

children for smoking, 53% screen/counsel parents for smoking, and 53% prescribe inhaled corticosteroids (ICS). According to O'Laughlen et al., nurse practitioners identified three common barriers: writing for ICS, peak flow meters, and smoking for children and/or parents. Nurse practitioners also stated that time, education materials, support staff, equipment, and reimbursement made performing the tasks difficult. Poor adherence was based on remembering classification parameters, various brands, dosing of ICS, triggers, and time or resources to provide asthma education and asthma action plans (O'Laughlen et al., 2013).

Almutawa et al. (2013) found that heavy workloads were the most frequent reasons for not adhering to follow-up guidelines as well as difficulty with patient compliance and the belief that the guidelines were not complete. Patient compliance was considered a key to success with asthma management. Therefore, noncompliance with follow-up schedules and management cause barriers that affect comorbid conditions. Improper peak flow meter and inhaler use are also common barriers (Almutawa et al., 2013). Cabana et al. (2001) found that, despite pediatrician awareness of EPR-3 guidelines, barriers exist that prevent them from adhering to the guidelines, including the lack of agreement, poor self-efficacy, or practice-related barriers. In conclusion improving adherence research needs to address each component barrier (Cabana et al., 2001). "Patient education for patients with asthma still seems to be suboptimal in frequency and is not uniformly provided to patients" (Shah et al., 2007, p. 812). Shah et al. (2007) determined that patients need more than 20 minutes in an appointment to receive adequate education on asthma. Rural patients and those who went to a private practice were more likely than urban patients to receive education. Shah et al (2007) also speculated that rural providers with less access to specialty care were apt to give more comprehensive care.

Gaps in literature include quality improvements to help remedy the barriers identified. Very limited data were found that examined all levels of licensed providers or incorporated collaboration with school nurses. Few articles have looked at rural asthma management in the United States. Harrington et al. (2013) recommended further research in health literacy and asthma education, especially in deprived socioeconomic areas.

Summary of the Review of Related Literature

The literature reveals different barriers to asthma management depending on the perspective of the approach. Primary Care Providers, caretakers, and school nurses are interrelated in the goal of controlling asthma in school-age children. Table 1 gives a synopsis of the barriers identified in this literature review. The purpose of this study is to identify barriers to asthma management in a rural northwestern Pennsylvania healthcare system. The survey and educational program used for this study is the Physician Asthma Care Education (PACE) program endorsed by the National Institute of Health.

Table 1

Identified Barriers

Primary Care Physician	Parents/Caregivers	School Nurses
Workload and time constraints	Split families	Communication
Patient compliance	Remembering to take medications	Parents
Reimbursement	School support	Providers
Lack of equipment	Availability to take time out of work	Community
Staff		Literacy—health and English
Spirometry		Socioeconomic status
Education resources		

Chapter 3

Methodology

The study design was a modified cross-sectional study. The modification was the exclusion of role playing parts of an educational program offered by the National Institute of Health (NIH) website called "Physician Asthma Care Education (PACE)". This was done so it could be presented in a 2-hour time frame. The study was offered to providers working in four counties of rural northwestern Pennsylvania served by a regional health system. This information was intended to determine if certain age groups, types of practices, or locations form patterns that can be utilized in a quality improvement program for the facility.

The educational program was offered healthcare system wide through email distribution at the investigator's work place. The sample group was aimed to all providers including physicians, advance practice nurses and physician assistants. The sample group consisted of physicians, nurse practitioners, and physician assistants. Inclusion criteria included working in one of the four counties and providing healthcare to school-age children. The exclusion criteria were providers who do not work with children, are currently unemployed, are not a licensed provider, and/or do not practice in the four-county area. The expected sample size was 25 to 50 providers. The actual number of attendance was twenty-two with eleven meeting the criteria.

Implied consent was given by completion of the questionnaire and educational seminar. The study was not blind, but the investigator used a numbering system in the place of names and the letters "A" for pre-education and "B" on the post surveys to indicate time of survey completion. The investigator worked with a statistician to provide statistical data. A demographic survey was used to determine location of practice, licensure, age, gender, years of

practice, and number of children seen a month. The statistical data was determined and analyzed using Welch's test and paired t-test. The Physician Asthma Care Education (PACE) is available free to anyone from the NIH website. Permission to use a modification of the PACE program and survey was obtained from the Center for Managing Chronic Disease, University of Michigan. Permission to use the health system for this project was obtained from the Chief Medical Officer and the Continuing Medical Education (CME) committee. The Edinboro University of Pennsylvania Investigational Review Board (IRB) granted expedited review.

Demographics were determined and analyzed Welch's test. The PACE program utilizes the Likert score use "1" being "not at all confident" or "helpful" and "6" being "extremely confident" or "helpful". The PACE survey includes the following topics: communication and counseling of patients and caretakers, confidence of asthma medications, knowledge of the EPR-3 guidelines, setting goals with patients and caregivers regarding their asthma management, and providing asthma education to patients and caretakers at their education level (The Regents of the University of Michigan, 2006). Reliability and validity have already been determined by the University of Michigan and is endorsed by the National Institute of Health (NIH).

The Investigation Review Board for Edinboro University of Pennsylvania and letters of approval from the Chief Medical Officer (CMO) and Continuing Medical Education Committee (CME) at Penn Highlands Health System were obtained prior to investigation. A list of affiliated providers, permission to contact them using the system's group-wide email, and conference facilities were requested from the CMO and CME committee. A teleconference system was available but was not used because of poor response from outlying facilities in the system regarding the presentation. The CME committee then provided the locale for the presentation and offered CME credit for attendance of the program. Two surveys were then provided with the

demographics page on top. Upon completion of the program the surveys were collect and given to the statistician. The CME committee independently provided CME credit to attendees via email later.

Summary of Methodology

This project used a demographic and pre- and post-survey while presenting an educational seminar utilizing PACE program offered on the NIH website. Prior to performing this seminar permission was obtained from the Chief Medical Officer and CME committee of a rural hospital system in Northwestern Pennsylvania. Investigational Review Board approval was granted by Edinboro University of Pennsylvania for expedited review of this project. The program was offered and performed in a local provided by the hospital. Data was compiled and completed by a statistician using Welch's test and paired t-test.

Chapter 4

Results and Discussion

This study used a demographic survey and the Physician Asthma Care Education (PACE) program and survey to educate and evaluate barriers to diagnosis and treatment of asthma in school-age children. Of the twenty-two surveys administered, eleven fit the study criteria. The only demographics that could be stratified due to the small sample size were licensure and gender. The statistically significant barriers were identified by Welch's test and paired t-tests. Questions regarding inhaled medications and teaching caretakers/children about identifying issues with asthma were found to have greatest barriers. It was also found that Nurse Practitioners / Physician Assistants have a greater impact for this kind of educational program than physicians.

Results

A group presentation was done utilizing the Physician Asthma Care Education (PACE) program and survey. A total of sixteen attendees responded to the survey, of which eleven (N=11) met the inclusion criteria. Surveys that were incomplete or answered by non-licensed providers were eliminated. A blind survey conducted pre-and post-PACE presentation was done by labelling the pre-test as "test A" and the post-test as "test B." The demographic information of the eligible participants consisted of age, years of practice, type of licensure, race / ethnicity, gender, county of primary practice, location of practice (rural, urban, suburban) and average number of children seen in the office a month.

Of the eleven providers, the mean age was 48 years of age and mean years of practice was 14.5 years. 14.5 of years. Of the eleven respondents, fifty-five percent were physicians and forty-five percent were Nurse Practitioners and Physician Assistants. The group identified as white (100%). The 55% of respondents were male while 45% were female. The main county of practice was Clearfield (73%).The remaining three counties had the following representation: Jefferson (18%), Elk (9%), and Forest (0%). Seventy-three percent of providers saw at least 5 children a month in clinical practice.

Table 2

Demographics (n=11)

Age	$\mu = 48$
Years as provider	$\mu = 14.5$
Provider type	
Physician	55%
Nurse Practitioner / Physician Assistant	45%

County of primary practice	
Clearfield	73%
Jefferson	18%
Elk	9%
Rural Health Clinic	18%
>5 children /month	73%

From the PACE questionnaire, confidence versus helpfulness was evaluated using 2-sample *t*-tests. Comparison of individual questions for pre-and post-educational presentation used Welch's Tests and paired *t*-tests. Question scores to treating asthma in children in the pre-education questionnaires were analyzed using Welch's Test (Table 1) resulting in: $F(24,90.2128) = 4.16$ and $R^2 = 27.36$ which yields ($p = 0.000$) therefore rejecting the null hypothesis with mild confidence in ($p = 0.000$). Individual questions were compared using an 95% CI to determine which questions were significantly different. (Figure 1).

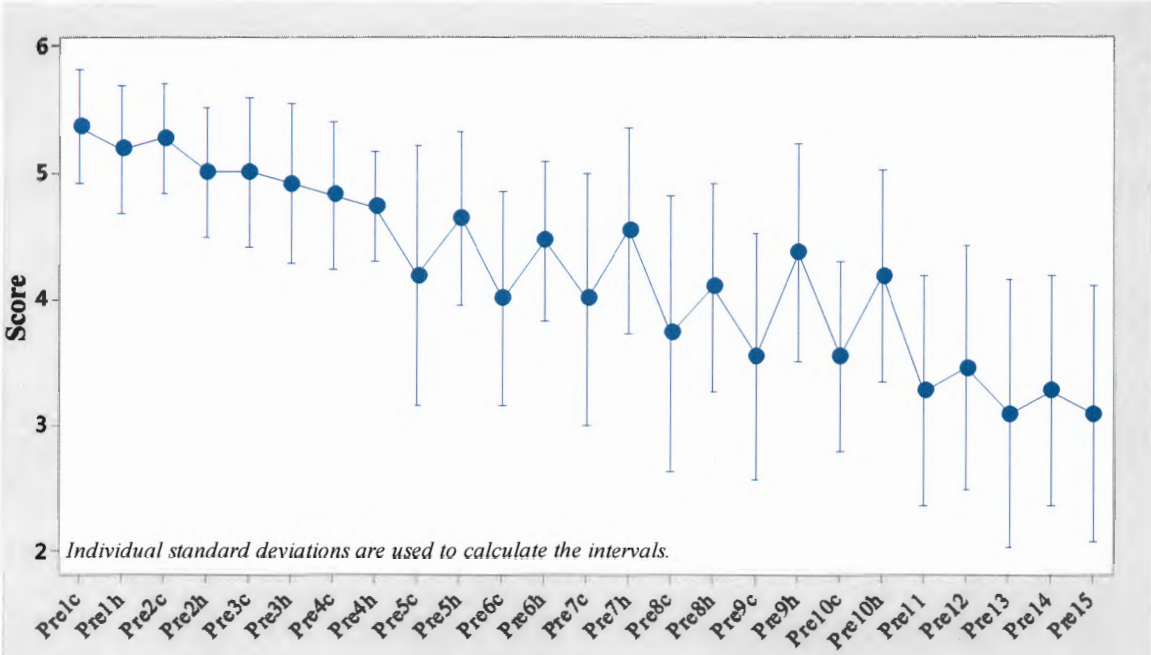

Figure 2. 95% CI Plot for the mean of pre-education questions (Pre1c, Pre1h, etc.)

A 2-sample *t*-test was preformed to test confidence scores versus helpfulness scores, H_0: $\mu_{Help} = \mu_{Confident}$ versus H_a: $\mu_{Help} > \mu_{Confident}$ of questions numbered 5-10 on the pre-education questionnaire. This results in $t\ (125) = 2.47$ yielding ($p = 0.007$). Therefore, confidence questions ($M = 3.83$, $SD = 1.39$, $N = 66$) differ significantly from helpfulness questions ($M = 4.38$, $SD = 1.13$, $N = 66$) for question 5 through 10 for pre-education questions (Figure 2).

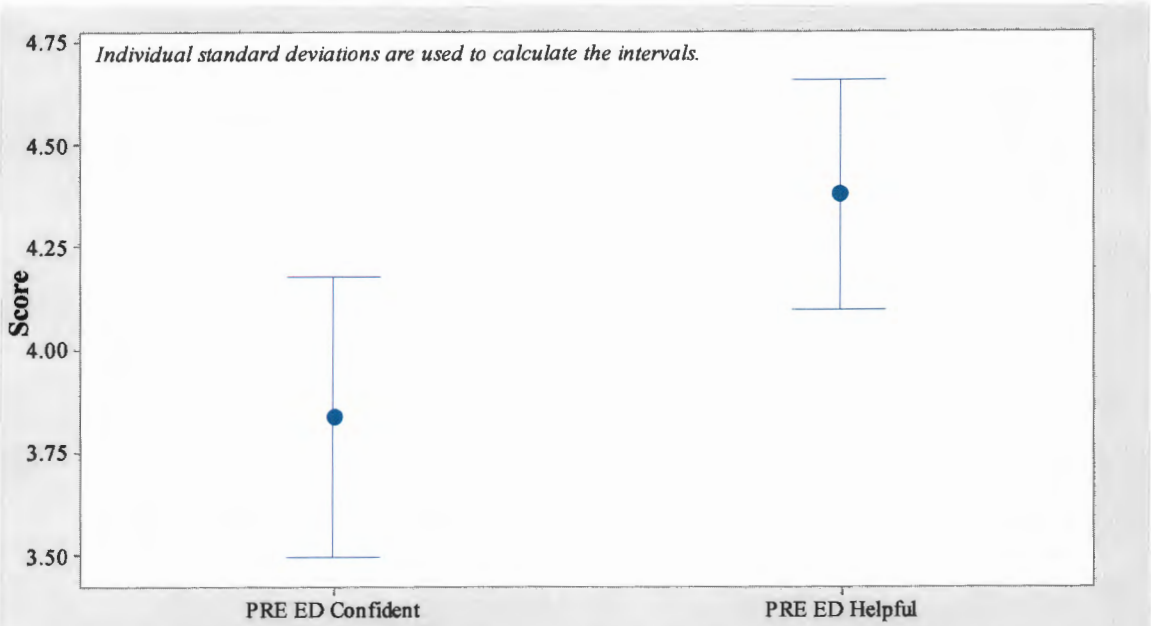

Figure 3. 95% CI Plot for the mean of Question 5 through 10 confidence versus helpfulness questions

The differences between pre-and post-presentation scores were analyzed using a paired *t*-test to test H_0: $\mu_{\text{Difference (Post-Pre)}} = 0$ versus H_a: $\mu_{\text{Difference (Post-Pre)}} > 0$ for each question by comparing each 95% CI question to zero. (Figure 3) The Mean, Standard deviation and 95% CI for each question are in (Table 2).

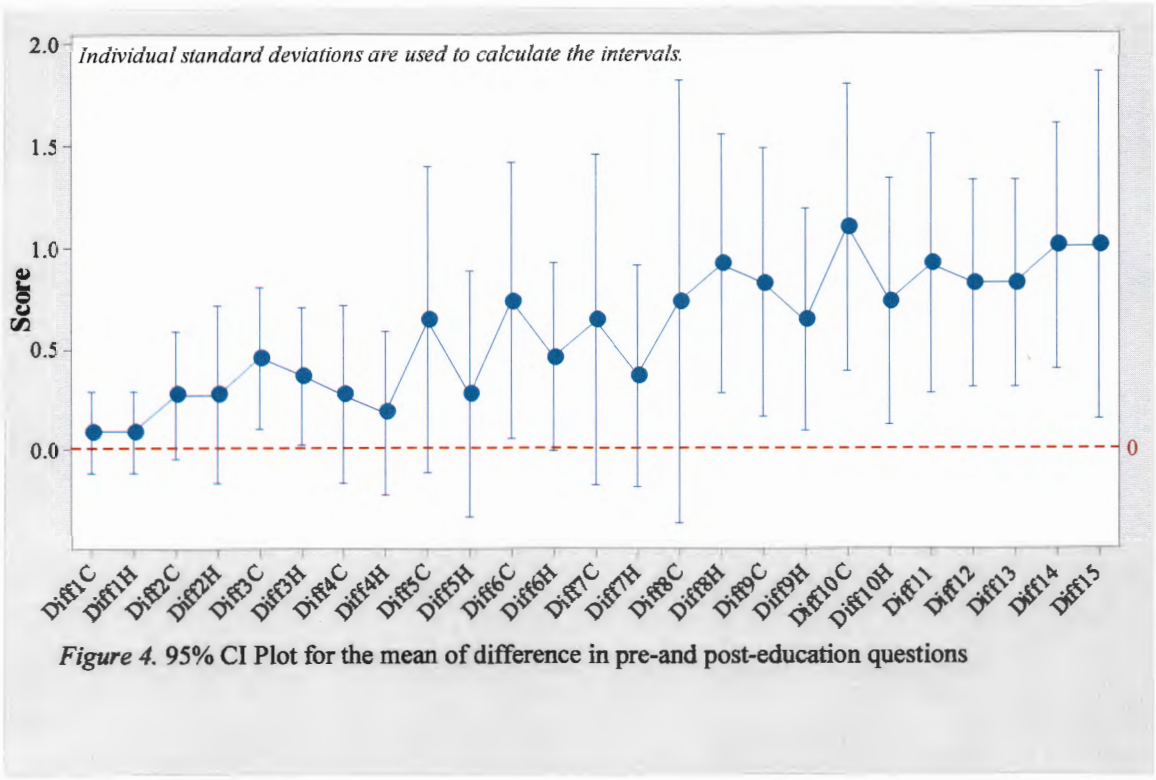

Figure 4. 95% CI Plot for the mean of difference in pre-and post-education questions

Table 3

Difference in Pre-and Post Question Scores

Question	*N*	*M*	*SD*	95% CI
Diff1C	11	0.0909	0.3015	[-0.1116, 0.2935]
Diff1H	11	0.0909	0.3015	[-0.1116, 0.2935]
Diff2C	11	0.273	0.467	[-0.041, 0.587]
Diff2H	11	0.273	0.647	[-0.162, 0.707]
Diff3C	11	0.455	0.522	[0.104, 0.805]
Diff3H	11	0.364	0.505	[0.025, 0.703]
Diff4C	11	0.273	0.647	[-0.162, 0.707]
Diff4H	11	0.182	0.603	[-0.223, 0.587]
Diff5C	11	0.636	1.12	[-0.116, 1.389]
Diff5H	11	0.273	0.905	[-0.335, 0.880]
Diff6C	11	0.727	1.009	[0.049, 1.405]
Diff6H	11	0.455	0.688	[-0.007, 0.916]
Diff7C	11	0.636	1.206	[-0.174, 1.447]
Diff7H	11	0.364	0.809	[-0.180, 0.907]
Diff8C	11	0.727	1.618	[-0.360, 1.814]
Diff8H	11	0.909	0.944	[0.275, 1.543]
Diff9C	11	0.818	0.982	[0.159, 1.478]
Diff9H	11	0.636	0.809	[0.093, 1.180]

Diff10C	11	1.091	1.044	[0.389, 1.793]
Diff10H	11	0.727	0.905	[0.120, 1.335]
Diff11	11	0.909	0.944	[0.275, 1.543]
Diff12	11	0.818	0.751	[0.314, 1.323]
Diff13	11	0.818	0.751	[0.314, 1.323]
Diff14	11	1	0.894	[0.399, 1.601]
Diff15	11	1	1.265	[0.150, 1.850]

Question scores to treating asthma in children in the post education questionnaires were analyzed using Welch's test. The result output from Welch's test is F (24, 90.2522) = 2.07 and R^2 = 17.99 which yields (p = 0.008) therefore rejecting the null hypothesis with mild confidence in (p = 0.008). This results in rejecting the null hypothesis that there was no difference in the mean scores of the questions. Individual questions were compared using a 95% CI plot to determine which questions were significantly different. (Figure 4).

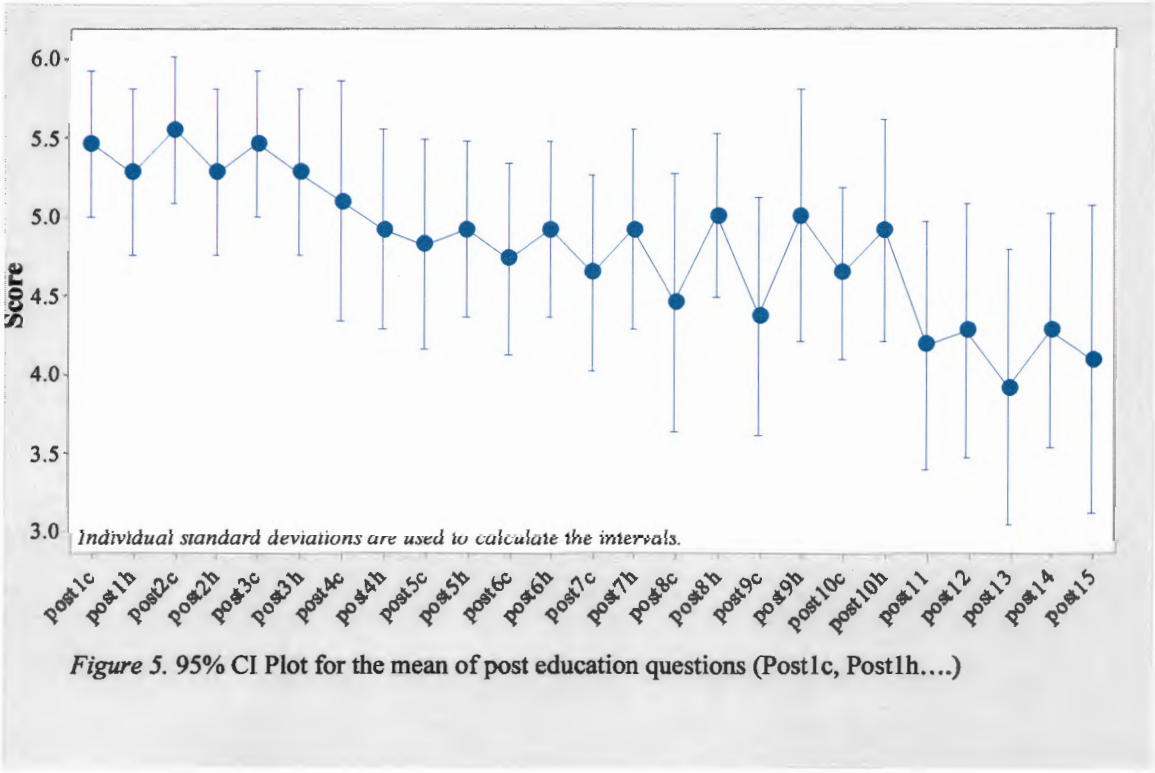

Figure 5. 95% CI Plot for the mean of post education questions (Post1c, Post1h....)

Evaluation of the effect of education on different provider types used a paired *t*-test stratified by provider type. One question, question 8H, in the physician group had a significantly greater than zero 95% CI [0.135,2.2]. Nurse Practitioners' and Physician Assistants' had significantly greater than zero results in questions 10C,11 - 15 post education with 95% CIs [.76,2.84], [1.24,2.36], [.72,2.08], [.72,2.08], [.18,3.42] respectively. (Figure 5).

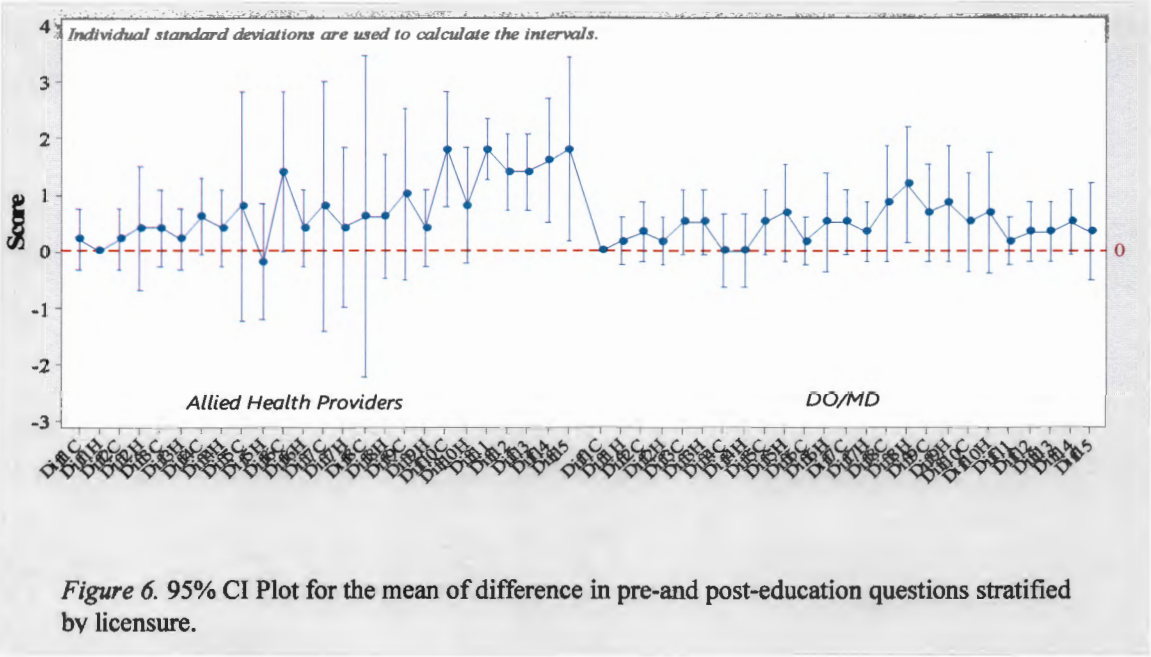

Figure 6. 95% CI Plot for the mean of difference in pre-and post-education questions stratified by licensure.

A 2-sample *t*-test was preformed to test confidence scores versus helpfulness scores, H_0: $\mu_{Help} = \mu_{Confident}$ versus H_a: $\mu_{Help} > \mu_{Confident}$ of questions numbered 5-10 on the post education questionnaire. This results in $t\ (125) = 2.03$ yielding ($p = 0.022$). Therefore, confidence questions ($M = 4.6$, $SD = 0.975$, $N = 66$) differ significantly from helpfulness questions ($M = 4.939$, $SD = 0.909$, $N = 66$) for question 5 through 10 for post education questions. (Figure 6).

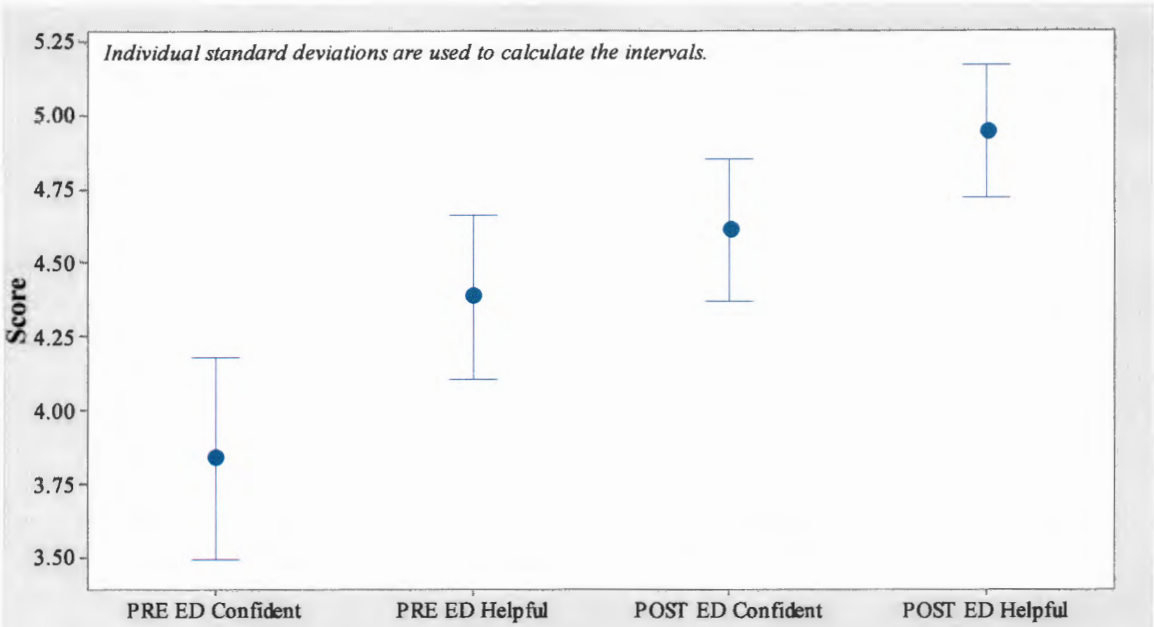

Figure 7. 95% CI Plot for the mean of Question 5 through 10 confidence versus helpfulness questions

Discussion of Results

Overall there was a good response rate to those that attended the educational opportunity, a 72% survey return rate of which 68.75% qualified in the sample pool. Twenty-two surveys were handed out at the beginning of the program; sixteen returned and eleven were qualified. The excluded surveys were incomplete or Registered Nurses (RN). The demographics were stratified and any group size less than five were considered too small for analysis. Licensure and gender were stratification variables. All but one physician was male and Nurse Practitioners / Physician Assistants (NP / PA-C) had all females except one.

Figure 1 demonstrates the difference in the scoring in 95% CIs of pre-education questions with the Likert scale score responses on the Y-axis and the question numbers on the X-axis. The resulting output for our Welch's test with F (24, 90.2128) = 4.16 and (p = 0.000) indicates that at least one on the questions is significantly different than the others. The confidence of the p-value is mild to moderate due to increased variations in scores given R^2=27.36. Looking more closely

at Figure 1, we can see that question 1-4 differ from 10-15 and confidence components in question 7, 8, and 9. This indicates that the questions that were significantly lower for the pre-education surveys are our barriers to begin with.

Assessment of barriers for providers in treating asthma found that after question four, the questions had variation in scores between confidence and helpfulness. The first four questions of the survey were generalized questions in confidence or helpfulness in communication techniques with patients and/or caretakers and not asthma specified. A 2-sample *t*-test was used in testing whether the difference in confidence versus helpfulness in pre-education questions 5- 10 was significant. ($p = 0.007$) at a significance level of alpha = 0.05 tells us the null hypothesis can be rejected. In other words, providers understood what attributes are helpful but did not have confidence in addressing them.

After the PACE presentation was done, attendees were again asked to complete the survey. Again, using Welch's test, the questions were reviewed. The ($p = 0.008$) was significant and the null hypothesis was rejected implying at least one question is statistically different from the rest. The confidence of the *p*-value is mild to low due to increased variations in scores given R^2=17.99. Figure 4 demonstrated and increase in the post survey results in the confidence portion in the general communication questions and selecting doses of daily inhaled steroids (#13). There is also an increase in confidence in questions addressing teaching, planning and treating asthma, questions 5-13.

95% Confidence intervals were plotted demonstrating mean pre-and post-survey differences (figure 3). A paired *t*-test was run for each question resulting in Questions 3,6,8-15 all having intervals above zero. This tells us there is significant evidence to reject the null hypothesis. In rejecting the hypothesis, it can be said that modified PACE program helped

improve the scores of the questions. Overall, only a slight increase in confidence compared to helpfulness scores in post-education questions were seen when comparing the two groups (Figure 5) as seen in our 2-sample *t*-test.

Paired *t*-test was used to identify intervals of mean score differences that did not contain zero and whether more question from either group were affected by the education (Figure 6). Education in provider types has more 95% CIs over zero for the NP / PA-C group than the Physicians' group. Physicians' had one question greater than zero while NP / PA-C 's had questions 10-15 with significant results. This is evidence that the Physicians' group did not respond as well to the education as the NP / PA-C group. This tells us that significant differences in question scores for question 10C-15 are dependent upon provider type.

In conclusion of the data collection, it was found that Welch's test was an appropriate tool because of the small p-value. The first four questions were statically higher than the last five questions (figure 1&4). The first four questions, being more generalized communication based, leads us to assume the respondents were assessing themselves in the entire practice and the remainder of questions regarding asthma. Questions regarding inhaled medications and teaching caretakers/children about identifying issues with asthma has results suggesting likely barriers to treating asthma. Question 10 stated below was identified as the greatest barrier among the providers

> Help the child and the caretaker to use criteria for making decisions about asthma management (e.g., recognizing signs that the therapeutic plan is not working, identifying the triggers before instituting environmental changes, establishing a plan for deciding when to stay home from school because of asthma)?

Education was found to help lessen the barrier in the post survey response. Finally, education for Nurse Practitioners and Physician Assistants had a greater impact for than education with physicians. This suggests that physicians have different barriers than Nurse Practitioners / Physician Assistants or Physicians do not respond as well to this education type.

Limitations

The PICO question for this study is: What are the barriers to the diagnosis and treatment of asthma among school-age children in northwestern Pennsylvania? This study found that there are barriers to treating asthma among school-age children however the sample size was small. The barriers, as a group or by individual question may have different outcomes with a larger sample size. Will providers' demographics make a difference in the outcomes? This null hypothesis was not proven. Rural Health Clinic status and other demographic differences makes the outcomes difficult to validate due to the small sample size. The PACE survey does not specify diagnosing asthma clearly but does educate on teaching triggers and management. Developing a quality improvement project to meet Physicians', Nurse Practitioners', and Physician Assistants' perceived barriers to the EPR-3 guidelines, requires more participants to attend educational programs. An inadvertent outcome came from lack of provider utilization of educational resources provided, use of email and/or word of mouth for these events, and perceived apathy for after work hours continuing medical education activities.

Chapter 5

Summary, Conclusions, and Recommendations

Summary of Findings

Asthma affects nearly ten percent of Pennsylvania children. The national prevalence of asthma in school-age children is eight percent. Pennsylvania Department of Health (PADOH)

reports a ten percent mortality and morbidity rate from asthma. In Pennsylvania, an estimated twenty-eight percent of children miss at least one day of school because of asthma. There is a known correlation between rural and low-income children and higher prevalence of asthma.

This study had eleven of the sixteen returned surveys that met inclusion criteria. Using a modified version of the PACE program and its survey, barriers identified by Nurse Practitioners, Physician Assistants, and physicians included inhaled medications and teaching caretakers and/or children to identify issues with their asthma. We found that Nurse Practitioners and Physician Assistants had a better response, less barriers, after the education than physicians. This suggests that physicians may have different barriers than other providers. The demographic location of practice, rural health versus non-rural health, did not make a significant impact on this study.

Implications for Nursing

Implications to nursing include utilizing programs like PACE to educate and continue to develop nursing core values on a holistic approach to patient care. Utilizing the techniques and skills needed to communicate with patients and caretakers regarding asthma management help the ease the burden of asthma to the child. In return, this will increase the confidence in management of asthma in school age children. An Advanced Practice Nurse's ability to incorporate the holistic approach to patient care with the allopathic approach to medicine will decrease barriers identified in this study and in previous research.

Recommendations for Further Research

Further research should include better techniques in readily identifying asthma in children, and increase comfort in medications for this age group. Further research on

medications, therapeutic management, identifying triggers, establishing asthma action plans, and more efficient ways to incorporate into family practice should be considered when the next version of asthma guidelines is published. At the time of this paper the current guidelines are ten years old and more medications and indications for classes of medicines have been added. Finally, finding a better way to recruit interest from providers at all levels, will aide in developmental improvement overall.

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