2021

The Role of Specialty Care in Pediatric Management in Minnesota

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THE ROLE OF SPECIALTY CARE IN PEDIATRIC ASTHMA MANAGEMENT IN MINNESOTA

A MASTER'S THESIS SUBMITED TO THE GRADUATE FACULTY

GRADUATE SCHOOL BETHEL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF SCIENCE IN PHYSICIAN ASSISTANT

JUNE 2021

ABSTRACT

Childhood asthma can be a challenging condition to manage and often requires individually tailored pharmacologic therapy in order to prevent symptom exacerbation and subsequent hospitalizations. Many patients and their families seek guidance from primary care providers or specialty care clinics to help in navigating appropriate medication management and symptom control. This study aimed to identify the role of specialty care management in pediatric asthmatics through the completion of a systematic chart review of patient records obtained from a Minnesota-based pediatric pulmonology clinic. The methodology included a qualitative retrospective cohort analysis which focused on patient referral source, specific treatment interventions, and the corresponding effect on patient outcomes through the utilization of specialty care management. The study gathered data from direct chart review as well as statistical analysis using a paired t-test. The results indicated that the most frequent referral source leading to specialty care consultation came from the patient's primary care provider. Patient medication regimens were also evaluated for the most appropriate and effective treatment options. Lastly, the results showed a statistically significant change in asthmatic symptom control and improved patient outcomes by incorporating specialty care management. The findings suggested how specialty care consultation, most commonly based on a referral from a primary care provider, may impact patient outcomes and improve overall quality of life.

ACKNOWLEDGEMENTS

We would like to extend our thanks, acknowledgment, and gratitude to our committee chair Cynthia Goetz, MPAS, PA-C, as well as our committee member Dr. Donald Hopper, PhD. This thesis would not have been possible without their guidance and support. Another thank you to Lisa Naser, PA-C for her constant encouragement and expertise. Finally, we would like to thank our families for all of the love and support they have given us during this process.

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Chapter 1: Introduction

Introduction

Asthma is one of the most prevalent childhood illnesses throughout the world (Allergy & Asthma Network, 2016; Centers for Disease Control and Prevention, 2019a; Global Initiative for Asthma, 2019a). This chapter provides key background information about pediatric asthma, as well as explains the research question answered by this study. The purpose of this study sought to retrospectively analyze a specific pediatric asthma specialty care clinic in Minnesota during January 2018 through December 2018 and identify the most common referral sources, types of medication utilized, and subsequent patient outcomes. Chapter one illuminates the significance of this research to the healthcare community, and explores the limitations of this study.

Background

Oxygen provides fuel for the body to perform conscious and unconscious actions that support life. Breathing aids in the recruitment of oxygen from the environment, introducing it into the lungs and then into the bloodstream to be distributed (Longo, Kasper, Jameson, Fauci, Hauser, & Loscalzo, 2012). This process also assists in the excretion of waste product, carbon dioxide, through exhalation (Emmett & Palmer, 2018). As a result, pH may be acutely regulated with changes in breathing (Emmett & Palmer, 2018). When this process is disturbed or altered, catastrophic and irreversible damage can occur. Asthma is a condition of the lungs that causes bronchospasms leading to reduced airflow out of the lungs (Longo et al., 2012). Exacerbations of asthma can result in low oxygen saturations leading to ED visits, hospitalizations, or even death (Xhelo, 2017). The risk of exacerbation increases with poorly controlled asthma, therefore, it is important to manage asthma appropriately.

There are many subsets within the main diagnosis of asthma. These subsets include exacerbating triggers as well as the classification of severity. Common triggers among pediatric asthmatics include viral illnesses, exercise, weather, smoke exposure, allergens, and irritant exposures (Sawicki & Haver, 2018). With the variation in triggers and types, asthma may present differently. However, commonly associated symptoms include cough, wheeze, dyspnea, chest tightness, or allergic symptoms (Sawicki & Haver, 2018). Depending on the incidence of symptoms and pulmonary function testing, asthma is classified as either intermittent, mild persistent, moderate persistent, or severe persistent. These classifications direct providers to the appropriate treatment plan, using international recommendations (Global Initiative for Asthma, 2019a). Treatment includes a step-down approach utilizing different combinations of inhaled corticoid steroids, leukotriene receptor antagonists, and bronchodilators (Global Initiative for Asthma, 2019a).

In 2017, the CDC published statistics that demonstrated 8.4% of children in the United States were diagnosed with asthma (Centers for Disease Control and Prevention, 2019a). In Minnesota, this percentage was slightly decreased at 7.4%, with 310,955 cases (Centers for Disease Control and Prevention, 2019b). MN Community Measurement is an organization within the state that collects and publishes patient outcomes for different illnesses, including asthma. According to the 2017 MN Community Measurement data, 180,043 children had uncontrolled asthma (MN Community Measurement, 2019). In a retrospective study, it was demonstrated that 44% of pediatric patients did not follow up with a specialty care following an emergency department visit, opposing guidelines put forth by the American Academy of Allergy, Asthma & Immunology (Price, Bjermer, Bergin & Martinez, 2017).

Problem Statement

Asthma is a chronic illness that with proper medical therapy can be well-controlled. However, asthma management may be complicated by different factors leading to poorly controlled asthma. Poorly controlled asthma comes with an increased risk of exacerbations resulting in clinic visits, emergency department visits, or even hospitalizations. Annually, children requiring a trip to the emergency department is 20% (Dondi et al., 2017). Those who have required emergency interventions are at an increased risk of developing another severe asthma attack (Dondi et al., 2017). According to Minnesota Community Measurement, only 57.9% of pediatric asthmatics in the state are well-controlled (MN Community Measurement, 2019). Currently, there is limited research about the role of specialty management of pediatric asthma.

Purpose

The purpose of this study sought to retrospectively analyze a specific pediatric asthma specialty care clinic in Minnesota during January 2018 through December 2018 and identify the most common referral sources, types of medication utilized, and subsequent patient outcomes. This study explored the impact of specialty care in pediatric asthmatics, by looking at different parameters following specialty care management. This was completed by analyzing different treatment options utilized, as well as patient outcomes. New patients were reviewed to research common trends in referral patterns. Using a retrospective analysis, this study aided in understanding the role of pulmonary specialty care in the pediatric population with asthma in Minnesota.

Significance of the Problem

In the pediatric population, asthma exacerbations are one of the top causes of admissions to the hospital and can be life-threatening (Dondi et al., 2017). The mortality rate for children ages 0-4 years old in the United States is 1.8% and nearly doubles with ages 5-17 years old to 3.2% (Centers for Disease Control and Prevention, 2018). Due to the prevalence of hospital admissions and emergency department visits, asthma control is critical in improving the physical health and quality of life in pediatric patients. Asthma may be managed by a primary care provider or by specialty care provider such as an allergist or pulmonologist. With the questions proposed in this study, the role of specialty management will be examined. This information may be useful for primary care providers when considering a referral. This may also be a helpful resource for parents of children with poorly controlled asthma.

Research Questions

The intent of this research project was to analyze the following questions using an in-depth chart review of pediatric patients seen at a pulmonology specialty care clinic in the Minnesota metro from January 2018 through December 2018:

1. What were the most common referral sources leading to specialty consultation for pediatric asthmatics management and control?
2. What was the role of specialty care management in pediatric asthma? Specifically, what types of interventions, counseling, or treatments were offered to Minnesota patients at this specialty care clinic from January 2018 through December 2018?
3. How did specialty care management influence or affect pediatric asthmatic outcomes?

Limitations/Delimitations

This study was limited due to the inability to control for patient compliance with treatment recommendations or availability of resources. Additionally, this study could not account for the primary care management of the pediatric patients before coming into the specialty care clinic, nor specifically, determine when a referral was discussed and the time in which the patient chose or was able to come in for the initial assessment and how that may have impacted outcomes. Lastly, another limitation would be the available treatment therapy recommendations and options available during the predetermined timeframe of January 2018 through December 2018. Recently, the 2019 Global Initiative for Asthma (GINA) published new recommendations that could be considered the most fundamental change in asthma management in 30 years (Reddel et al., 2019). One of these new asthma management recommendations discouraged the once-standard use of short-acting bronchodilators alone as needed, and now advised the use of a combination inhaler with a corticosteroid and long-acting bronchodilator for rescue inhalation (Global Institute for Asthma, 2019). As this study reviewed patient records before this change in guidelines, the treatment strategies utilized at that time may not be what is currently recommended for pediatric asthmatic control. As far as the delimitations of the research, this study was confined to the analysis of chart reviews at one specific pulmonology specialty care clinic in the Minnesota metro area. Additionally, the charts reviewed spanned from a pre-determined time frame from January 2018 through December 2018.

Definitions of Terms

The following important terms are defined below and should be considered throughout this article and for the purpose of this study.

1. Asthma Control Test (ACT): A self-administered validated tool for subjectively assessing asthma control (Liu et al., 2007).
2. Bronchodilator: A substance that relaxes contractions of the smooth muscle within the bronchioles to improve lung ventilation (Anderson, 2002).
3. Dyspnea: A distressful sensation of uncomfortable breathing (Anderson, 2002).
4. Exacerbation: An increase in the seriousness of a disease marked by greater intensity in patient symptoms (Anderson, 2002).
5. Forced Expiratory Volume: The volume of air that can be expelled in a set period after full inspiration, usually set at one second (Anderson, 2002).
6. Forced Vital Capacity: The maximum volume of air that can be forcibly exhaled after full inspiration (Anderson, 2002).
7. Inhaled Corticosteroids (ICS): An effective anti-inflammatory medication for asthma used to increase lung function, reduce symptoms, and reduce the risk of asthma-related hospitalizations and death (Global Initiative for Asthma, 2019).
8. Leukotriene Modifiers: Target one part of the inflammatory pathway in asthma specifically blocking chemicals that cause the airways to tighten and narrow (Global Initiative for Asthma, 2019).
9. Long-Acting Inhaled Beta-Agonist Bronchodilators (LABA): A scheduled inhaled asthma medication used in conjunction with a corticosteroid to improve lung function as well as reduce symptoms and exacerbations (Global Initiative for Asthma, 2019).

10. Short-Acting Inhaled Beta-Agonist Bronchodilators (SABA): An inhaled asthma medication used as needed for quick relief of asthma symptoms and bronchoconstriction in exacerbation or preemptively for exercise-induced asthma treatment (Global Initiative for Asthma, 2019).
11. Spirometry: Laboratory evaluation of the air capacity of the lungs (Anderson, 2002).
12. Wheezing: A high-pitched whistling sound associated with labored breathing (Anderson, 2002).

Conclusion

In summary, as asthma continues to be a prevalent and life-limiting childhood illness, it is essential to understand how best to control this disease. This research discussed how the incorporation of specialty care may have influenced outcomes in pediatric asthmatic management using a statistical analysis and chart review derived from a Minnesota pediatric pulmonology clinic. The following chapter provides a comprehensive understanding of the asthmatic condition as well as an in-depth literature review and analysis of the current research in asthma treatment and the specific quality measures and rankings of pediatric asthmatic management in Minnesota.

Chapter 2: Literature review

Introduction

"When you inhale, you are taking the strength from God. When you exhale, it represents the service you are giving to the world (Iyengar, 2005)."

Breathing is a precious gift; it is an ability that should not be taken for granted. But what happens when that ability is hindered, when the capacity to inhale and exhale is challenged and limited? This chapter discussed the obstructive breathing condition of asthma and how it affects the pediatric population. More specifically, this chapter provided an in-depth research analysis of the current literature describing patient presentation, diagnostic criteria, treatment modalities, and collaborative interdisciplinary care for prevention and management of pediatric asthma. Lastly, this chapter reviewed the recent data collected in the state of Minnesota on quality measurements of pediatric asthmatic control and how this correlated with the use of specialty care clinic referrals to assist in the prevention, management, treatment, and overall improved patient outcomes.

Pathophysiology

Asthma is a respiratory syndrome defined by varied airflow narrowing and obstruction (Longo, 2012). Asthmatics are more susceptible to a wide range of triggering factors that lead to inflammation within the airways. This perpetuates the bronchial narrowing which reduces airflow and causes characteristic wheezing, shortness of breath, chest tightness, cough, and dyspnea (Longo, 2012). Asthma is generally reversible through the use of bronchodilators, but in some patients, the disease can become chronic and irreversible despite pharmacologic intervention (Longo, 2012). An acute asthma attack or exacerbation occurs when the environmental triggers cause the smooth muscle lining the bronchi and bronchioles to narrow

and contract (Xhelo, 2017). Additionally, the inflammation and pulmonary hyperresponsiveness induced by the trigger generates mucus production leading to increased breathing difficulty. As the chest tightens, wheezing occurs as air whistles through the narrowed space. Eventually, it becomes harder for the asthmatic to exhale producing hyperinflation and air trapping within the lung space. The body must now work harder to maintain adequate gas exchange throughout the bloodstream. Without proper intervention, death can occur from the lack of oxygen delivery to essential organs such as the brain and heart (Xhelo, 2017).

Prevalence

Globally, asthma is considered one of the most common chronic diseases worldwide (Masoli, Fabian, Holt, & Beasley, 2004). Estimations taken from the Global Initiative for Asthma (GINA) reported over 300 million people in the world of all ages and ethnicities currently have asthma and approximately 250,000 individuals die from the disease each year (Masoli et al., 2004). Asthma has become more common in both children and adults around the world in recent decades. The increase in the prevalence of asthma has been associated with an increase in atopic sensitization and is paralleled by similar increases in other allergic disorders such as eczema and rhinitis (Liu et al., 2007). Rates of asthma increase as communities adopt western lifestyles and become urbanized. (Masoli et al., 2004). As the global population increases, there is likely to be a corresponding increase in the number of asthmatics worldwide. Estimations show that there may be an additional 100 million people afflicted with asthma by 2025 (Masoli et al., 2004). More recent literature on global prevalence of asthma has been hindered by variations in definitions as well as method collection making accurate incidence reporting difficult (Litonjua & Weiss, 2018).

Furthermore, asthma is the most common chronic disease of childhood (Sawicki & Haver, 2018). In the United States, the Center for Disease Control and Prevention (CDC) reported the prevalence of children who have ever been diagnosed with asthma to be over nine million, and over six million children still have the disease (Centers for Disease Control and Prevention, 2017b). The following diagrams represented the prevalence of pediatric asthma cases collected from the 2017 National Health Interview Survey data from national and state surveillance systems administered by the CDC seen on the following figures. Figure 1 illustrated the population of pediatric asthmatics broken down by age. Figure 2 separated the prevalence of pediatric asthma by gender. Figure 3 distinguished between ethnic groups and the prevalence of childhood asthma.

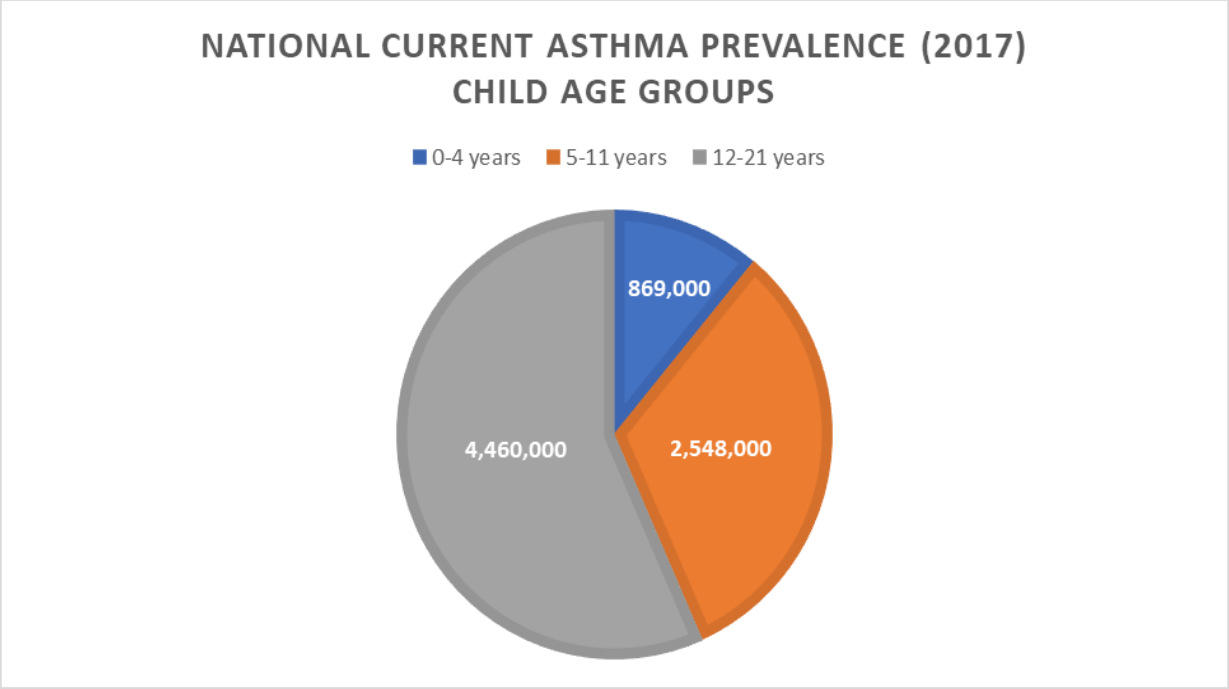

Figure 1. 2017 national current asthma prevalence categorized into childhood age groups of 0-4 years, 5-11 years, and 12-221 years (Centers for Disease Control and Prevention, 2017b).

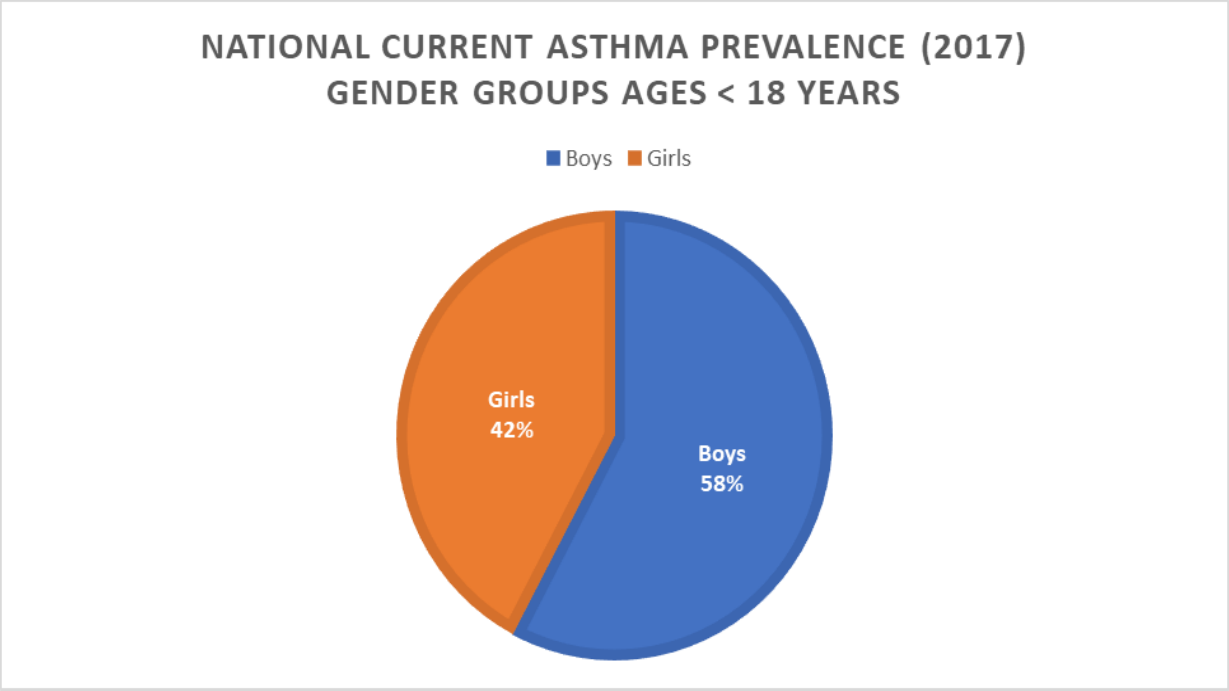

Figure 2. 2017 national current asthma prevalence in pediatrics categorized into boys and girls (Centers for Disease Control and Prevention, 2017b).

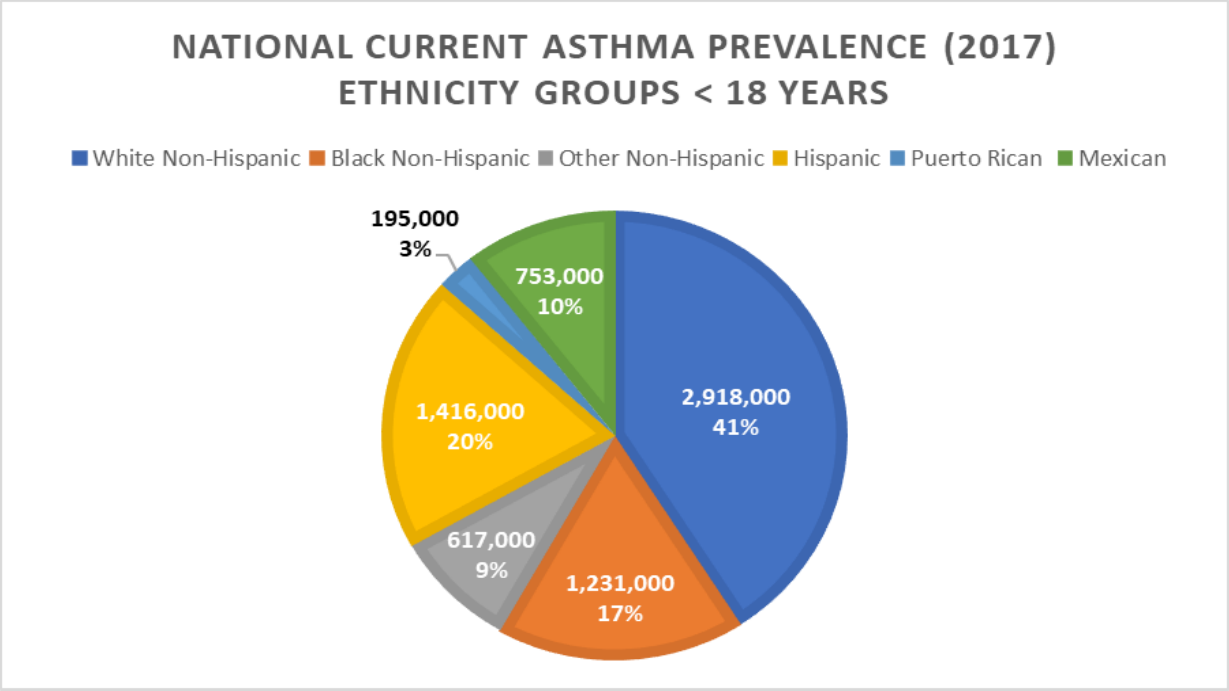

Figure 3. 2017 national current asthma prevalence categorized by ethnicity groups of White (non-Hispanic), Hispanic, Black (non-Hispanic), Mexican, Other (non-Hispanic), and Puerto Rican (Centers for Disease Control and Prevention, 2017b).

Risk Factors and Etiology

The presence of viral upper respiratory infections is the primary triggering factor for the development of wheezing illness and acute asthma exacerbations in childhood (Gern, 2014). During infancy, babies infected with respiratory syncytial virus (RSV) may develop mild respiratory symptoms of which are self-limiting and without complications (Gern, 2014). Alternatively, some infants with RSV experience more severe symptoms of cough, wheezing, and hypoxia which are associated with an increased risk for developing asthmas later in childhood. Exposure to severe viral infections may adversely affect long-term pulmonary physiology and development which predisposes infants to asthma or other lung-related chronic conditions (Gern, 2014).

Additionally, a number of prenatal and perinatal factors including maternal age greater than 30 years, genetics, tobacco use, diet, medications (specifically acetaminophen intake), vitamin D deficiency and absence of breastfeeding have been suggested as possible risk factors in the development of pediatric asthma, although the collected data has not been conclusive (Litonjua & Weiss, 2019). A strong association, however, does exist with allergic disease and the development, severity, and persistence of asthma (Sawicki & Haver, 2018). Atopy is the genetic predisposition to create specific IgE antibodies following exposure to allergens correlating with airway hyperresponsiveness and is considered a prerequisite for the development of allergic disease (Sawicki & Haver, 2018). The Epidemiology and Natural History of Asthma Outcomes and Treatment Regimens (TENOR) study, an observational study of patients with severe or difficult-to-treat asthma, determined that children with severe asthma tend to have marked elevated atopy and that allergen exposure was a noted trigger for asthma symptoms for the estimated 80% of childhood asthmatics with comorbid allergic disease (Chipps et al., 2007).

Signs and Symptoms

Each individual with asthma is unique in his or her triggers. Common triggers include upper respiratory infections, allergen exposure, or exercise (Miller, 2018). Other triggers include the weather and temperature, hormonal fluctuations, medications, and emotional states (Miller, 2018). Anxiety and stress are two emotional triggers that may influence an exacerbation (Miller, 2018). For some individuals, triggers may be due to selective irritants, such as smoke exposure or air pollution (Miller, 2018). Due to the various triggers that exacerbate asthma, symptoms may vary from case to case.

Of pediatric asthmatics, 80% of children will become symptomatic before age five (Sawicki & Haver, 2018). One common symptom of asthma in children is cough (Sawicki & Haver, 2018). Without other presenting symptoms, children with asthma may be misdiagnosed with bronchitis (Sawicki & Haver, 2018). An asthmatic cough is often a non-productive cough, although it may be productive (Sawicki & Haver, 2018). Children may cough throughout the day, or they may cough nocturnally as well (Sawicki & Haver, 2018). A cough may also be seasonal, depending on the etiology of asthma. For example, if a child has allergic asthma that is triggered by ragweed, then he or she may have a lingering cough throughout the fall. Along those lines, a cough may follow certain triggers such as bonfires, laughing, or exercise (Sawicki & Haver, 2018). Children with a lingering cough that lasts longer than three weeks should be evaluated for asthma, as untreated asthma is the most common cause of chronic cough in children under three years old (Sawicki & Haver, 2018). Other common symptoms include chest tightness, dyspnea, and some children may have exercise limitations. Allergic symptoms may be present if a child has an atopic etiology such as rhinitis, conjunctivitis, or eczema (Sawicki & Haver, 2018).

The hallmark of asthma is the presence of a wheeze. This is a musical sound heard upon exhalation. Wheezing is often heard on physical exam through a stethoscope, although in severe cases a wheeze may be audible without the use of a stethoscope (Sawicki & Haver, 2018). During an asthma exacerbation, a lack of wheeze is considered an emergency, indicating extremely reduced airways (Sawicki & Haver, 2018). For children with asthma, physical examinations of the lungs outside of asthma exacerbation will often have normal findings (Sawicki & Haver, 2018). However, at baseline, some children may present with decreased air entry or wheezing, increased AP diameter, or prolonged expiratory phase on auscultation (Sawicki & Haver, 2018). This is indicative of poorly controlled asthma. Children with an allergic component may also present with an allergic salute or allergic shiners at baseline (Sawicki & Haver, 2018). An allergic salute is a nasal crease formed due to repeated rubbing of the nose, while allergic shiners are a result of venodilation beneath the eyes leading to swelling (deShazo & Kemp, 2018). Along with allergy symptoms, eczema and nasal polyps may also be found in children with asthma (Sawicki & Haver, 2018). An association between increased body mass index and increased severity of asthma is present, although the causation is controversial (Sawicki & Haver, 2018). During an exacerbation, tachypnea, hypoxia, wheezing, accessory muscle use, retractions, and prolonged expiratory phase may be found (Sawicki & Haver, 2018).

Diagnosis

In diagnosing children with asthma, patient history and physical exam can be suggestive of asthma. However, there are three criteria for the confirmation of an asthma diagnosis. Criteria include variable expiratory airflow limitation, documentation of reversible obstruction, and exclusion of differential diagnoses (Sawicki & Haver, 2018). Differential diagnoses for acute wheezing to rule out asthma include bronchiolitis, laryngotracheobronchitis, atypical infection,

bacterial tracheitis, foreign body aspiration, and esophageal foreign body (Sawicki & Haver, 2018). Chronic causes of wheezing can be split into anatomical and functional. Anatomical differential diagnoses include tracheobronchomalacia, vascular compression, tracheal stenosis, cystic lesions, tumors, lymphadenopathy, or cardiomegaly (Sawicki & Haver, 2018). Chronic functional differential diagnoses for wheezing include gastrointestinal reflux, recurrent aspiration, cystic fibrosis, primary ciliary dyskinesia, immunodeficiency, pulmonary edema, bronchopulmonary dysplasia, retained foreign body, bronchiolitis obliterans, vocal cord dysfunction, and interstitial lung disease (Sawicki & Haver, 2018).

In children over the age of five years old, spirometry is useful in the diagnosis of asthma. Forced vital capacity (FVC) reveals the total amount of air moving out of the lungs after a forced exhalation. Forced expiratory volume (FEV_1) measures the amount of air blown out in one second. In individuals with asthma, their FEV_1 may be decreased below 80% predicted value demonstrating an obstructive pattern consistent with asthma (Sawicki & Haver, 2018). Other values consistent with a diagnosis of asthma include a decreased FEV_1/FVC ratio below 85% predicted value, and FEF 25-75 below 65% predicted (Sawicki & Haver, 2018). FEV_1/FVC ratio is beneficial in assessing the current impediment of air and function of the lungs, while FEV_1 has been shown to be a predictor of future exacerbations (Sawicki & Haver, 2018). Spirometry should be repeated after bronchodilator usage. If FEV_1 values increase by 12%, then there is a significant response to albuterol. This helps diagnose asthma in individuals with normal FEV_1 values (Sawicki & Haver, 2018).

Spirometry is beneficial for the diagnosis of asthma, however, this test is contraindicated for children under the age of five. Due to this, many different diagnoses may be given for recurrent wheezing. Reactive airway disease, wheezy bronchitis, asthmatic bronchitis, and

wheezing associated respiratory illness are some names used interchangeably in young children (Sawicki & Haver, 2018). For both young children and adolescents, patient history is important in confirming the asthma diagnosis. Taking a thorough history can help identify patterns in a child (Townshend, Hails, & McKean, 2007). Symptom patterns may help identify triggers or distinguish between differential diagnoses (Townshend et al., 2007). Do the symptoms occur with illnesses, with exercise, at grandma's house, at a certain time of the year, or during sleep are some questions that can help narrow down triggers (Townshend et al., & McKean, 2007). Obtaining a family history may help direct diagnosis if there is a significant history of asthma or eczema in the family (Townshend et al., 2007).

A thorough history can also help assess the degree of illness (Townshend et al., 2007). Some questions that may be beneficial in evaluating severity are "Is your child able to keep up with peers, are they missing school, has your child ever been prescribed respiratory medications, if so, have they been beneficial" (Townshend et al., 2007)? To make a diagnosis, patients may also be trialed on asthma medications. Responsiveness to these medications can be suggestive of asthma, specifically responsiveness to albuterol (Sawicki & Haver, 2018). Other tests may be done to rule out differential diagnoses, such as a chest x-ray, allergy testing, sweat chloride test, swallow study, and exhaled nitric oxide levels (Sawicki & Haver, 2018).

Once asthma has been diagnosed, the provider must categorize the severity of asthma. Children with asthma may be diagnosed with exercise-induced, mild intermittent, mild persistent, moderate persistent, or severe persistent. Asthma in children is categorized based on symptom burden, short-acting beta-agonist (SABA) use, exercise limitations, lung function, and oral steroid use, as seen in Table 1. Classifications for asthma in children under 12 years old

remain the same as the criteria that are indicated for 12 years and older (Healthwise Staff, 2018). Asthma classifications help direct treatment.

Table 1

Diagnostic Criteria for Children 12 Years and Older (Pollart & Elward, 2009).

	Intermittent	Mild persistent	Moderate persistent	Severe persistent
Symptoms	≤ 2 days per week	> 2 days per week, but not daily	Daily	Throughout the day
Nocturnal symptoms	≤ 2 times per month	3 to 4 times per month	> once per week, but not nightly	Often 7 times per week
Short-acting beta-agonist use	≤ 2 days per week	> 2 days per week, but not more than once per day	Daily	Several times per day
Exercise limitations	None	Minor limitations	Some limitations	Extreme limitations
Lung function	FEV_1 percent predicted normal; FEV_1/FVC normal	FEV_1 ≥ 80 percent predicted; FEV_1/FVC normal	FEV_1 60-80 percent predicted; FEV_1/FVC reduced 5%	FEV_1 < 60 percent predicted; FEV_1/FVC reduced 5%
Oral steroid use	0-1 per year	≥ 2 per year	≥ 2 per year	≥ 2 per year

Note. Asthma classification is based on symptom burden and lung function. Classification directs appropriate treatment.

Treatment

Asthma management utilizes a step-down approach for treatment (Global Initiative for Asthma, 2019). The Global Initiative for Asthma (GINA) published new guidelines for stepwise treatment in June 2019, as seen in Table 2. For children ages six to eleven years old step one consists of an as needed low dose inhaled corticoid steroid (ICS) in combination with a short-acting beta antagonist (SABA), or daily low dose ICS and as needed SABA (Global Initiative for

Asthma, 2019). The next step, step two, is to increase to a daily low dose ICD or a leukotriene receptor antagonist (LTRA) and SABA as needed (Global Initiative for Asthma, 2019). Step three consists of a low dose ICS-long acting beta-agonist (LABA), or medium-dose ICS, or low dose ICS and LTRA, along with SABA as needed (Global Initiative for Asthma, 2019). For increased control, step four includes a medium-dose ICS-LABA or a high dose ICS-LABA or by adding tiotropium. SABA should be used as needed for exacerbations (Global Initiative for Asthma, 2019). The final step includes referring for a phenotypic assessment and additional add-on therapies (Global Initiative for Asthma, 2019). These guidelines resemble previous guidelines from GINA's 2008 report, however, guidelines for children 12 years and older have changed concerning the rescue inhaler preference (Global Initiative for Asthma, 2019).

Table 2

Treatment Guidelines for Children 6-11 Years Old (Global Initiative for Asthma, 2019).

Treatment	Step 1	Step 2	Step 3	Step 4	Step 5
Preferred controller		Daily low dose ICS	Low dose ICS-LABA or medium dose ICS	Medium dose ICS-LABA Refer for expert advice	Refer for phenotypic assessment May add on additional therapy
Other controller option	Low dose ICS as needed with SABA use, or daily low dose ICS	LTRA, or low dose ICS as needed with SABA use	Low dose ICS + LTRA	High dose ICS-LABA, or add-on tiotropium or add-on LTRA	Add-on anti-IL5, or add-on low dose OCS (consider side effects)
Reliever	SABA as needed				

Note. 2019 GINA guidelines for asthma management.

For children and adolescents 12 years and older, a step-down approach continues to be utilized for asthma management. Table 3 outlines this stepwise approach. Step one consists of an

as needed low dose ICS-formoterol or a SABA as a recuse inhaler options (Global Initiative for Asthma, 2019). Step two is a low dose ICS or LTRA, and an as needed ISC-formoterol (Global Initiative for Asthma, 2019). Step three is a low dose of ICS-LABA or a medium-dose ICS or a low dose ICS and LTRA, along with a low dose ICS-formoterol as needed (Global Initiative for Asthma, 2019). Step four is stepping up to a medium dose ICS-LABA or a high dose ICS and tiotropium or LTRA, along with a low dose ICS-formoterol (Global Initiative for Asthma, 2019). Traditionally, a SABA has exclusively been used as a rescue inhaler, however, in the updated guidelines a low dose ICS-LABA may replace the SABA during exacerbations (Global Initiative for Asthma, 2019). In the role of acute exacerbations for both age groups, a SABA inhaler or nebulization and oral steroids are beneficial.

Table 3

Treatment Guidelines for Adults and Children 12 Years Old and Older (Global Initiative for Asthma, 2019).

Treatment	Step 1	Step 2	Step 3	Step 4	Step 5
Preferred controller	As-needed low dose ICS-formoterol	Low dose ICS-LABA	Low dose ICS-LABA	Medium dose ICS-LABA	High dose ICS-LABA Refer for phenotypic assessment Consider add-on therapy
Other controller option	Low dose ICS as needed with SABA use	Medium dose ICS or low dose ICS+LTRA	Medium dose ICS or Low dose ICS+LTRA	High dose ICS, add-on tiotropium or add-on LTRA	Add low dose OCS, but consider side effects
Reliever	ICS-formoterol as needed		Low dose ICS-formoterol for patient prescribed maintenance and reliever therapy as needed		
Other reliever option	SABA as needed				

Note. 2019 GINA guidelines for asthma management.

Individuals with a diagnosis of asthma are expected to fill out a control test at the beginning of their appointment for state-wide reporting purposes (MN Community Measurement, 2018). Children ages 12 years and older fill out a five question survey referred to as the Asthma Control Test (ACT), which assesses their perceived level of asthma control (Minnesota Department of Health, 2010a). Additionally, they are also asked to fill out the number of emergency department (ED) visits and hospitalizations they have had in the past year due to asthma (Minnesota Department of Health, 2010a). Children under the age of 12 fill out a Childhood Asthma Control Test (CACT) with the assistance of a parent or guardian to assess their control level. There are four questions on the CACT that are intended for the child to answer as best as he or she can, while three questions are solely for the parent or guardian to answer (Minnesota Department of Health, 2010b). The CACT also records the number of ED visits and hospitalizations due to asthma in the past 12 months (Minnesota Department of Health, 2010b). A passing score for both the ACT and CACT is scoring above a 19 (Minnesota Department of Health, 2010a).

Not only is this information reportable to the state, but it can also be used to guide treatment (MN Community Measurement, 2018). In a study by Schatz et al. (2006), 313 patients at an asthma specialty clinic had their ACT scores compared to their spirometry as well as their provider's rating of their asthma control. This study demonstrated that the ACT score was reliable for assessing asthma control (Schatz et al., 2006). Therefore, these questionnaires should be considered along with symptom burden and physical exam when considering the appropriate treatment.

With the step-down method, providers may start asthma control higher than what may be required for long term control. After two to three months of control, the level of management

may be decreased until the child is on the lowest amount of medication required for optimum control (Sawicki & Haver, 2018). Asthma is often managed through primary care providers, however, there are circumstances when a referral to a pulmonologist or allergist is required. For example, a referral may be made when the diagnosis of asthma is uncertain (Sawicki & Haver, 2018). Referrals may also be made when asthma is difficult to control or exacerbations frequently occur (Sawicki & Haver, 2018). One other indication for referral to a specialist is adverse effects from asthma medication (Sawicki & Haver, 2018). Although asthma is often managed in family medicine, specialty care plays an integral role in pediatric asthma control.

Specialty care in pediatric asthma management often consists of a team of doctors, nurses, physician assistants, nurse practitioners, and respiratory therapists (Fanta, 2017). In the pediatric setting, the pediatricians overseeing specialty care clinics specialize in pulmonology or immunology (Fanta, 2017). Many pediatricians working with the pediatric asthmatic population receive fellowship training as well as advanced certification in the subspecialty of pediatric pulmonology and allergy/immunology awarded by the American Board of Pediatrics (Althouse & Stockman, 2016).

Asthma not only affects physical health but also can impact the social health of patients and their families. Children who are diagnosed with asthma may develop anxiety surrounding their disease or even the fear of dying (Sawicki & Haver, 2018). Asthmatic children's social health may be impacted as well with fears of being ostracized for being "different" (Sawicki & Haver, 2018). Asthma may also impact children's performance in school. Nocturnal symptoms may prevent individuals from sufficient sleep, leading to difficulty concentrating and difficulty learning (Sawicki & Haver, 2018). Asthma is also associated with increased absenteeism. In a study by Sullivan et al. (2017) a retrograde study looked at school-aged children with asthma and

compared them to those without. The findings revealed that children with asthma miss school 1.54 times more often than those without (Sullivan et al., 2017). Children with asthma were found to have a lower level of physical activity in school (Williams, Hoskins, Pow, Neville, Mukhopadhyay, & Coyle, 2010). In the study by Williams et al. (2010), it was demonstrated that teachers often had difficulty differentiating inattentiveness due to asthma from lack of motivation. Therefore, children with asthma were more likely to have limitations placed on their participation (Williams et al., 2010).

Not only can a diagnosis of asthma have implications on the individuals themselves, but also their families. Controller inhalers are often very expensive, even with insurance. This diagnosis may become a financial burden on families (Sawicki & Haver, 2018). This may also lead to restrictions on travel or social events that families attend (Sawicki & Haver, 2018). For example, if a grandparent smokes families may avoid visiting the grandparent's home. Family dynamics may also shift, with the primary focus on the individual with asthma. This may lead to sibling resentment for special treatment (Sawicki & Haver, 2018). Although asthma physically affects an individual's body, it is important to acknowledge that there are many other aspects of a child's life that a diagnosis of asthma may affect.

MN Community Measurement

MN Community Measurement is a nonprofit organization that was created in 2005 (MN Community Measurement, 2019). The mission of this organization is to create transparency and accountability for healthcare in Minnesota (MN Community Measurement, 2019). This group’s stakeholders are a diverse group of healthcare providers and insurance companies, as well as patients and government employees (MN Community Measurement, 2019). In 2010, Minnesota passed legislation that required the Minnesota Department of Health (MDH) to publish standards

of care for quality control statewide ("Statewide programs," n.d.). With this law, every clinic and hospital in Minnesota are required to report their patient outcomes for specific conditions, such as asthma, annually ("Statewide programs," n.d.).

Clinics and hospitals may use MN Community Measurement's data to compare amongst surrounding practices and to improve quality of care (MN Community Measurement, 2019). Not only can clinics compare themselves, but this data may be utilized as a tool for parents to research and compare clinic's asthma control rates (MN Community Measurement, n.d.). This annual report also allows insurance companies and government programs to look at outcomes, fueling the incentive for outcomes rather than volume reimbursement (MN Community Measurement, 2019). The reporting processes can be cumbersome for clinics, therefore, MN Community Measurement is working on improving this data collection process in hopes of providing easily accessible and accurate information (MN Community Measurement, 2019).

Annually, clinics and hospitals are ranked on their asthma control utilizing both patient-reported outcomes and performance measurements. Data is collected on statewide family medicine, internal medicine, pediatric, allergy and immunology, and pulmonary practices (MN Community Measurement, 2018). A reporting year includes the annual calendar year, during which time if a patient ages 5-17 years old with a diagnosis of asthma is seen by an eligible provider, then this patient must be reported for the clinic's denominator (MN Community Measurement, 2018). Eligible providers include medical doctors, doctors of osteopathic medicine, physician assistants, and advanced practice nurse practitioners (MN Community Measurement, 2018). The total number of eligible patients is then compared to the number of controlled patients to obtain the rate of optimally controlled asthmatics.

The numerator is determined by the number of patients who meet the following two criteria. The first criteria is passing the Asthma Control Test (ACT) for children ages 12 years and older, and the Childhood Asthma Control Test (CACT) for children ages five to eleven years old (MN Community Measurement, 2018). To pass the ACT or CACT, a patient must score a 20 or above. If neither of these tests are used, then the Asthma Therapy Assessment Questionnaire (ATAQ) may be used. A patient must obtain a score of zero on the ATAQ to be considered well-controlled for ages 5-17 years old (MN Community Measurement, 2018). The second criteria involves the risk of exacerbation. Patients must have reported less than two hospitalizations or visits to the emergency department for asthma in the previous 12 months (MN Community Measurement, 2018). If both of the criteria are met then a patient may be counted toward the numerator. The greater the ratio the better control a practice has with their asthmatic population (MN Community Measurement, 2018).

In the reporting process, there are some exclusions from a patient population perspective. For patients with a concurrent diagnosis of cystic fibrosis, chronic obstructive pulmonary disease, emphysema, or acute respiratory failure, these patients are excluded from the annual reporting (MN Community Measurement, 2018). In addition, there are also allowable exclusions including if the patient was in hospice, receiving palliative care, or in a permanent nursing home at any time during the reporting period (MN Community Measurement, 2018). Patients who have died before the measurement period was over or only had urgent care visits are also excluded (MN Community Measurement, 2018). In the most recent published report, the statewide average for optimally controlled asthma in children was 57.9% (MN Community Measurement, 2019). Comparatively, the 90th percentile of medical groups in Minnesota had an average ratio of 70.6% (MN Community Measurement, 2019). The range for medical groups

individually ranged from 0% to 83.9% of optimal control (MN Community Measurement, 2019). When compared to the national data from 2012-2014, on average half of children diagnosed with asthma were considered well-controlled (Center for Disease Control and Prevention, 2017a).

Specialty Care in Pediatric Asthma

Specialty care plays an important role in pediatric asthma management. In a study conducted in 2019, 149 children who presented to the emergency department for an asthma exacerbation were surveyed. Of those patients, 20% were seen by specialists for their asthma (Pade, Agnihotri, Vangala, Thompson, Wan, & Okelo, 2019). Of the population, three-fourths met the criteria for a referral to a specialist (Pade et al., 2019). Around 80% of the parents who were not seeing a specialist expressed interest in being followed by a specialist for their child's asthma management (Pade et al., 2019). This study demonstrated that the majority, 87%, of parents who were not seeing a specialist were not doing so due to the "perceived lack of necessity by their primary care provider" (Pade et al., 2019, p. 1). Another study by Agnihotri (n.d.) looked at children who presented to the emergency department for asthma exacerbations measuring the control of their asthma. This study demonstrated that there was a large population of patients who either had ED visit, hospitalization, or an ICU admission for asthma who were not managed by specialty care (Agnihotri, n.d.). The study also reported that only 1% of primary care providers were using validated questionnaires to assess their patient's asthma severity (Agnihotri, n.d.). It was suggested that this reduction in questionnaire use may contribute to a lack of recognition at the primary care provider level as to who should be managed by specialty care. This study also demonstrated that parents were less likely to pursue specialty care if their primary care provider did not recommend it (Agnihotri, n.d.). The findings of the study conducted by Agnihotri (n.d.) support those concluded by Pade et al. (2019).

Room for more documentation and exploration of the role of specialty care in pediatric asthma management is needed. Within 10 miles of Minneapolis, there are 7 specialty clinics for pediatric asthma (MN Community Measurement, n.d.). Asthma is a very common and potentially life-threatening illness that affects many children. Specialty care, whether by a pulmonologist or allergist, is an important step in controlling difficult or atypical asthma.

Conclusion

In summary, asthma is a common chronic illness that impacts 7.4% of children in Minnesota (Centers for Disease Control and Prevention, 2019b). The diagnosis, treatment, and management of this disease may require specialty care providers in order to provide optimal control. The Pade et al. and Agnihotri studies discussed in this chapter, demonstrated a correlation between patients who utilized specialty care management with a reduction in ED visits and hospitalizations. The following chapter will describe the methodology used to analyze the retrospective study of pediatric asthmatics managed by a specialty care clinic in Minnesota.

Chapter 3: Methods

Introduction

The objective of this study was to assess the role of specialty care in pediatric asthma management. Through the use of an in-depth chart review and analysis of pediatric patients at a specific asthma specialty care clinic, this research addressed the following questions:

1. What are the most common referral sources leading to specialty consultation for pediatric asthmatics management and control?
2. What is the role of specialty care management in pediatric asthma? Specifically, what types of interventions, counseling, or treatments were offered to Minnesota patients at this specialty care clinic from January 2018 through December 2018?
3. How does specialty care management influence or affect pediatric asthmatic outcomes?

The intent of Chapter 3: Methods was to provide a clear and precise understanding of the research methodology used in the assessment of the gathered data. This examination reviewed the study design and selected variables, the rationale for population selection criteria, experimental procedures, and the data collection process.

Study Design

The study was designed to be a descriptive, quantitative, retrospective, cohort study. This specific methodology was chosen as a means of producing an objective and thorough review of the gathered data and to provide insight into the proposed research questions. The descriptive research aimed to accurately describe the specific pediatric asthmatic population using the chart review process. The collected data was quantitative and based on the selected clinical parameters and numerical values such as PFT results. The research identified a specific cohort consisting of pediatric patients treated at a specialty care clinic and involved a retrospective examination of

patient records spanning from January 2018 through December 2018. Independent variables included medications and visit count. Dependent variables consisted of PFT values. These variables were used to describe the data and examine clinical outcomes identified through the analysis of patient records.

Population

The research data was collected and analyzed from the medical records at Children's Respiratory & Critical Care Specialists (CRCCS). This clinic provided quality health care in pediatric pulmonology and critical care medicine with six locations throughout Minnesota. This study's author was connected to this clinic through previous employment and received full access to patient records to compile research data.

The participants of this study were children up to the age of 18 years old with the diagnosis of asthma who were newly referred to CRCCS beginning January 2018 through December 2018 for an initial consultation and who had at least one additional follow-up appointment during that timeframe. These criteria were selected to specifically measure the interventions that were put into place by the specialty care provider instead of those set by the primary care provider before the initial consultation. The sample consisted of participants under the age of 18 as the clinic does not manage adult asthmatics and the research intended to focus specifically on pediatric patients. No other exclusion criteria was considered when selecting the population. The participation goal was to gather clinic records from between 50-100 patients to utilize for analysis purposes.

Experimental Procedures/Protocol

Quantitative clinical outcomes were reviewed to determine if there was a correlation between specialty care management and asthma control. Data was collected from CRCCS using their electronic medical record, eClinicalWorks (eCW). Inside of eCW was a function that allowed reports to be run on quantitative data. This function was called Enterprise Business Optimizer (eBO). Using eBO, a data set was created. Information that was pulled from this report included medical record number (MRN), date of service (DOS), ACT/CACT scores, ED visits/hospitalizations, and steroid bursts. This report was generated for asthma patients who presented to the clinic for the first time between January 2018 through December 2018, and who also completed a follow-up clinic visit during that timeframe. Consent was obtained through a general consent form updated annually seen in appendix A. The general consent form was resigned annually by parental guardians authorizing the release of protected health information for medical and scientific research purposes. Appendix B provided written consent to access electronic medical record data from CRCCS.

A chart review was completed for changes in classes of medication as well as for the source of referral. The classes of medications that were collected are included in Table 4. Dosing changes were also be tracked. These changes were recorded in an excel spreadsheet organized by class and potency of drugs.

Table 4

Classification of Drugs (Allergy & Asthma Network, 2016)

ICS Low	Flovent HFA 44 mcg QVAR HFA 40 mcg Asmanex HFA 100 mcg Budesonide Neb 0.5mg/2mL
ICS Medium	Flovent HFA 110 mcg QVAR HFA 80 mcg
ICS High	Flovent HFA 250 mcg Asmanex HFA 200 mcg
ICS-LABA Low	Advair HFA 45/21 mcg Symbicort HFA 80/4.5 mcg Dulera HFA 100 mcg
ICS-LABA Medium	Advair HFA 115/21 mcg
ICS-LABA High	Advair HFA 230/21 mcg Symbicort 160/4.5 mcg Dulera HFA 200 mcg
LTRA	Montelukast, Singulair
H1 anti-histamine	Cetirizine
Biologics	Xolair, Fasenra, Dupixent
Antibiotics	Alternate day Azithromycin
Steroids	Prednisone, Prednisolone, Dexamethasone, Triamcinolone
Albuterol	Proair, Ventolin, Xopenex
Albuterol & Ipratropium	DuoNeb

The referral source was also chart reviewed. Categories that referrals were organized into include referral from primary care provider (PCP), self-referral/friend or hospital follow-up. A hospital follow-up meant that a patient who had not previously established care with CRCCS was consulted by a pulmonologist while they were inpatient. At hospital discharge patients were instructed to schedule a follow-up appointment with CRCCS within four weeks.

Participant's protected health information (PHI) was protected by collecting de-identified information outside of their MRN and DOS. While the MRN was protected health information, this number was only used to correlate appointment and clinical outcomes to corresponding

patients. MRNs were excluded in statistical analysis. The electronic data, while being collected and analyzed, was kept on a password-protected computer owned by the researchers. After completion of the study, the data will be kept on an external storage device locked in the PA program office for a minimum of five years, per securing requirements for Bethel University's Physician Assistant Program and deleted from the researcher's computers.

Statistical Methods

Using the excel spreadsheet generated by eBO, descriptive statistics were used for PFT values. The frequency of the intervention type and referral methods were recorded. Clinical outcomes on the final visit were compared to those taken on the initial consultation utilizing a paired T-test in order to examine any statistically significant changes in PFT values.

Referral sources and medication changes were analyzed as well using graphics. The percentage of each referral source was displayed on a pie chart. This gave a visual representation of where the majority of referrals to specialty care originated. Bar graphs were created to compare medications at first appointment with changes made while under the management of CRCCS. The bar graph allowed any trends in medication changes at a specialty care level to be visualized.

Validity and Reliability

This study utilized previously established tools such as PFT values to evaluate clinical outcomes. In a study conducted by Schatz et al., patient-reported ACT scores were compared to PFT values and specialists ratings of the individual's asthma control (Schatz et al., 2006). This comparison demonstrated that ACT scoring is a reliable and valid tool for assessing asthma control (Schatz et al., 2006).

The National Asthma Education and Prevention Program recommended that PFTs be measured at the time of initial evaluation and repeated frequently to provide an accurate diagnosis and assessment of disease severity (Nair, Daigle, DeCuir, Lapin & Schramm, 2005). Without completion of PFTs, providers were more likely to overestimate the degree of asthma control leading to potential sub-optimal therapy and negative outcomes (Nair, Daigle, DeCuir, Lapin & Schramm, 2005). Additionally, adherence to the guidelines concerning the use of PFTs for asthmatic children was associated with a reduced risk of hospitalization (Moth, Schiotz, Parner & Vedsted, 2010). The three key factors of obtaining a valid PFT measurement included the use of accurate instrumentation, a patient capable of performing acceptable and repeatable measurements, and a motivated clinician to elicit maximum performance effort (Ruppel & Enright, 2012). In this way, PFTs were difficult to obtain in children younger than 5 years of age. However, in the study conducted by Eigen et al, valid and reproducible PFT measurements performed by trained pediatric pulmonary function technicians were greater than 80% of the 307 children between the ages of 3-6 years old (Eigen et al, 2001). For the purpose of this study, CRCCS did not collect PFT measurements on children less than the age of 5 years old.

Limitations/Delimitations

This study was limited due to the inability to control for patient compliance with treatment recommendations or availability of resources. Additionally, this study did not account for the primary care management of pediatric patients before coming into the specialty care clinic. Nor specifically, determined when a referral was discussed and the time in which the patient chose or was able to come in for the initial assessment and how that timing may have impacted outcomes. Another limitation requiring consideration was the availability of treatment therapy recommendations and options during the predetermined timeframe of January 2018

through December 2018. Recently, the 2019 GINA came out with new recommendations that may be considered the most fundamental change in asthma management in 30 years (Reddel et al., 2019). One of these new asthma management recommendations discouraged the once-standard use of short-acting bronchodilators alone as needed, to now advising for the use of a combination inhaler with a corticosteroid and long-acting bronchodilator for rescue inhalation (Global Institute for Asthma, 2019).

As this study reviewed patient records before this change in guidelines, the treatment strategies utilized at that time may not be what is currently recommended for pediatric asthmatic control. As far as the delimitations of the research, this study was confined to the analysis of chart reviews at one specific specialty care clinic in the Minnesota metro area. Additionally, the charts reviewed spanned from a pre-determined timeframe from January 2018 through December 2018 and consisted of patients who have completed an initial consultation as well as a follow-up appointment.

Conclusion

The purpose of this study sought to retrospectively analyze a specific pediatric asthma specialty care clinic in Minnesota during January 2018 through December 2018 and identified the most common referral sources, types of medication utilized, and subsequent patient outcomes. This chapter described the intended pediatric patient population, the chosen specialty care clinic, independent and dependent variables, and the experimental procedures and protocols utilized to gather the data. The information collected from the patient chart reviews was analyzed and presented in Chapter 4: Results. Chapter 5: Discussion reviewed the interpretation of the results in relation to the identified research questions.

Chapter 4: Results

Introduction

This study aimed to understand the role of specialty care in the pediatric asthmatic population in the Twin Cities. A chart audit of 352 patient's appointments from January 2018 through December 2018 was conducted. This audit acquired information regarding referral sources, number of visits, medication changes, and PFT changes. Microsoft Excel was used for the data analysis along with the XLSTAT Cloud application. Data was demonstrated via graphical displays, such as graphs and tables.

Demographics

The demographic information included children up to the age of 18 years old with the diagnosis of asthma. Of these children, they must have presented to the respiratory clinic as a new patient during from January 2018 through December 2018 and returned for at least one appointment during that same calendar year. 352 patients met these criteria and 924 appointments took place during the specified time frame. Data obtained from the qualifying visits met the criteria per Chapter 3: Methods.

Data Analysis

The initial research question asked about the source of referrals leading to specialty care consultation. Figure 4 illustrates the various patient referral sources. Of the 352 new patients, 25% of them became involved in specialty care due to an asthma exacerbation resulting in a hospitalization (Figure 4). 8% of patients presented on their own accord, and most patients, 67%, were referred by their primary care provider (Figure 4).

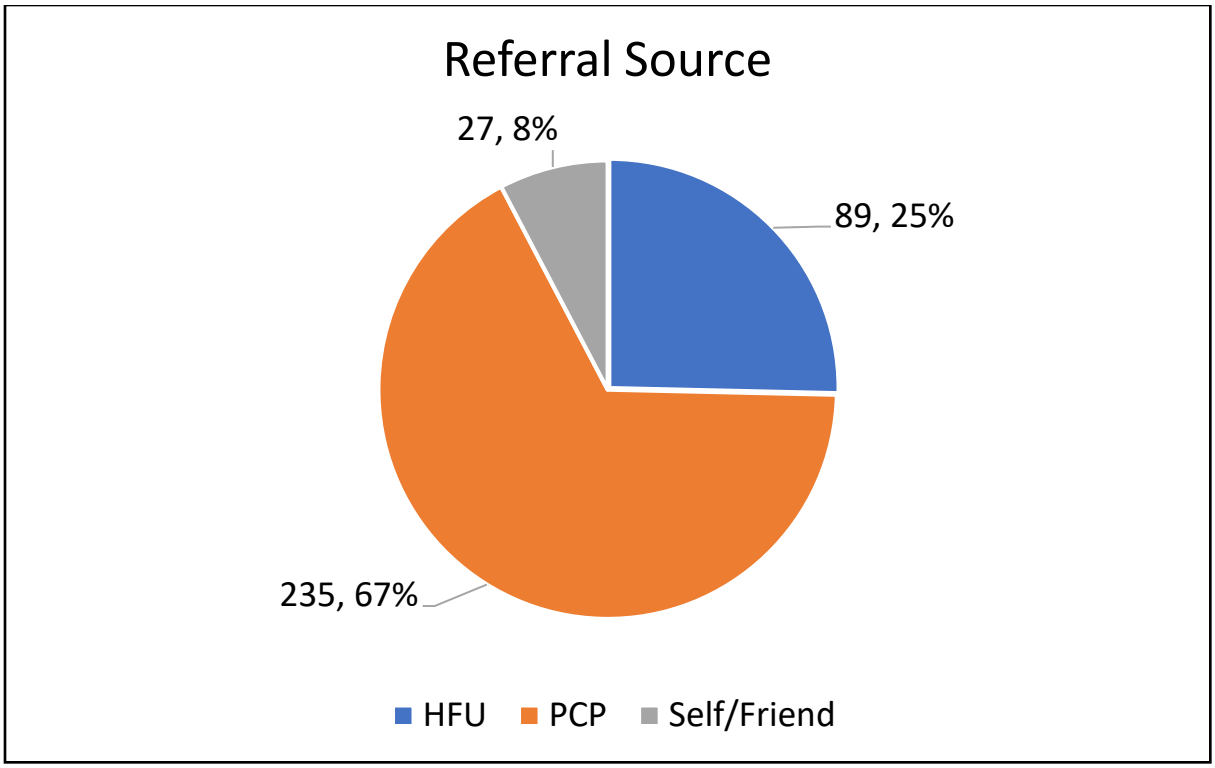

Figure 4. Referral source from the initial visit. HFU represents "hospital follow up", PCP represents "primary care provider", and self/friend is anyone who is not a medical provider directly involved in the patient's care.

The second research question addressed the role of specialty care management in asthma and the types of interventions used during patient visits. Upon chart review, during January 2018 through December 2018, there were 924 appointments. The frequency of visits in the calendar year varied from two to seven visits (Figure 5). The subsequent figures summarize the interventions utilized at each appointment depicting both current and initiated medications (Figures 6-11). 76 patients were started on a SABA during the initial visit (Figure 6). By the second visit, 348 out of 352 patients were on a rescue inhaler (Figure 7). 184 patients were started on or had a controller inhaler changed during the initial visit (Figure 6). On the second visit, 71 patients had a controller inhaler added or changed during the appointment (Figure 7).

During the first visit, 181 patients had oral steroids added to their treatment regimen for exacerbations (Figure 6).

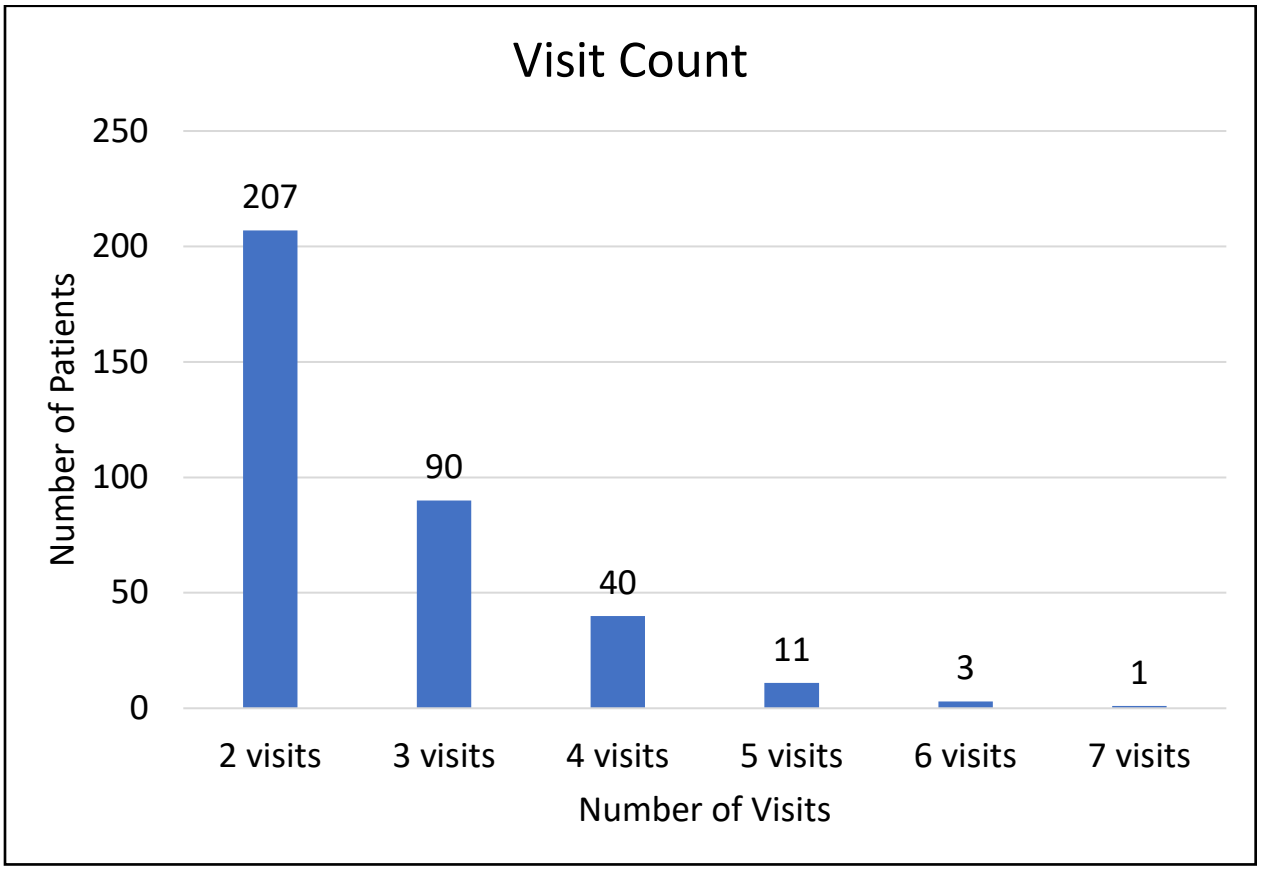

Figure 5. The number of visits per patient.

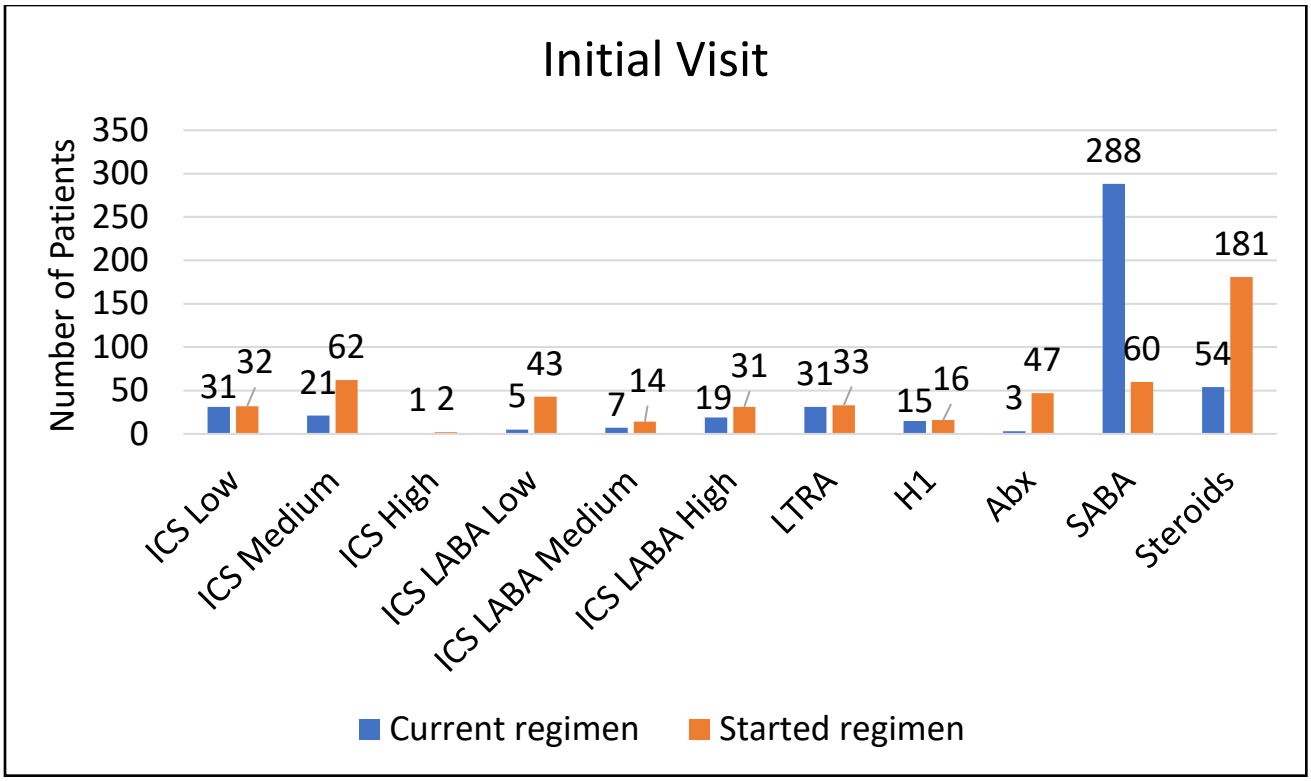

Figure 6. Medications summary after the initial appointment. 352 patients were included. Current regimen indicates that the medications were "continued" or "refilled." Started regimen indicates that the medication was started at that visit.

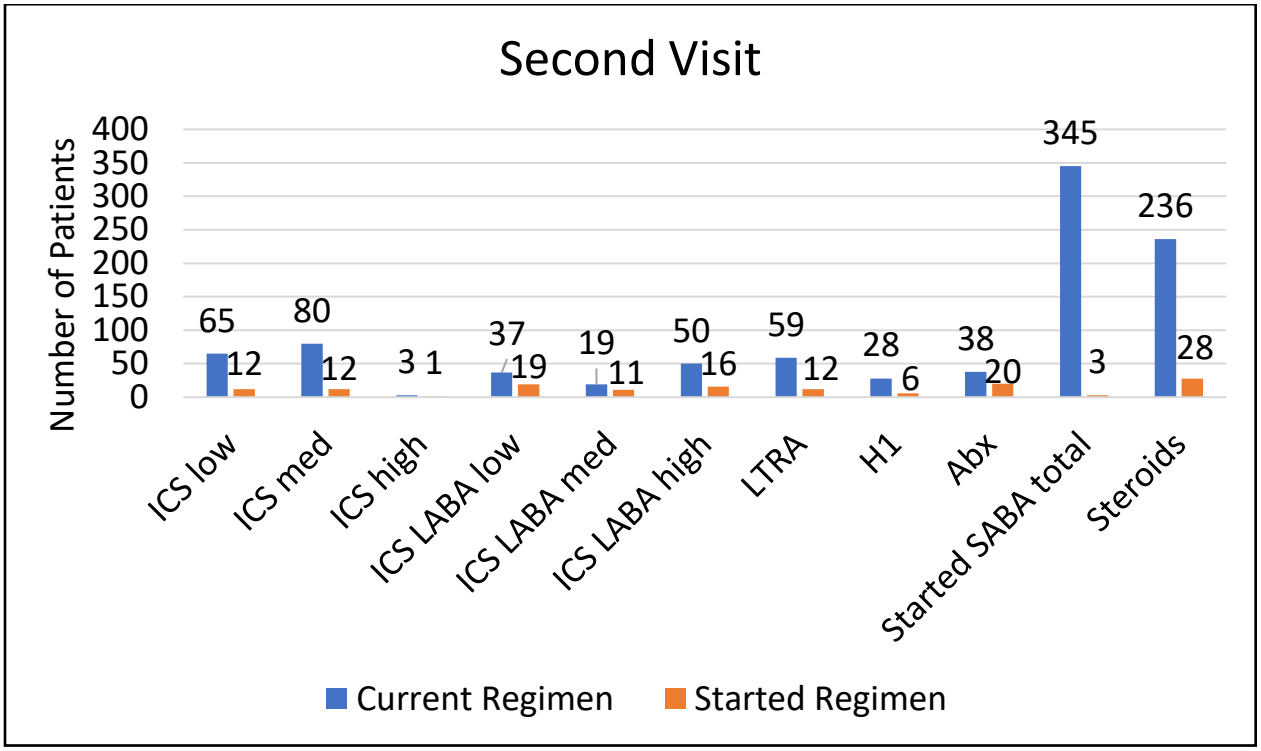

Figure 7. Medications summary after the second appointment. 352 patients were included. Current regimen indicates that the medications were "continued" or "refilled." Started regimen indicates that the medication was started at that visit.

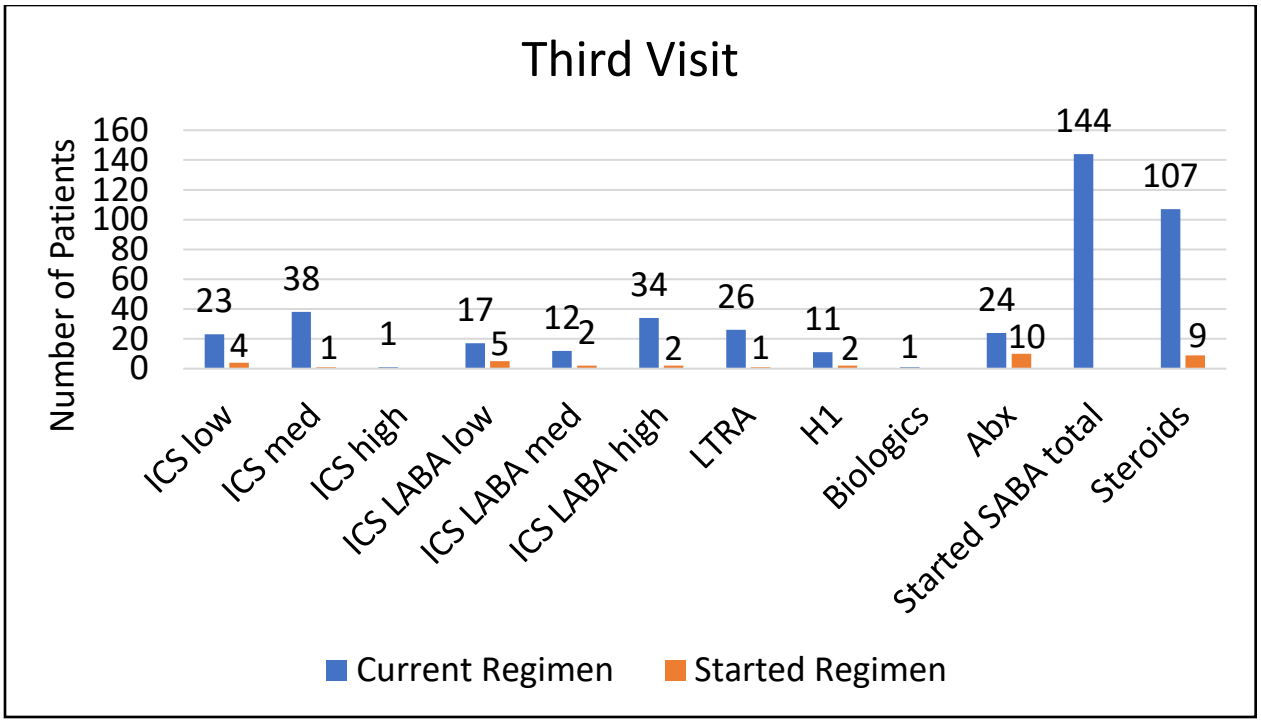

Figure 8. Medications summary after the third appointment. 145 patients were included. Current regimen indicates that the medications were "continued" or "refilled." Started regimen indicates that the medication was started at that visit.

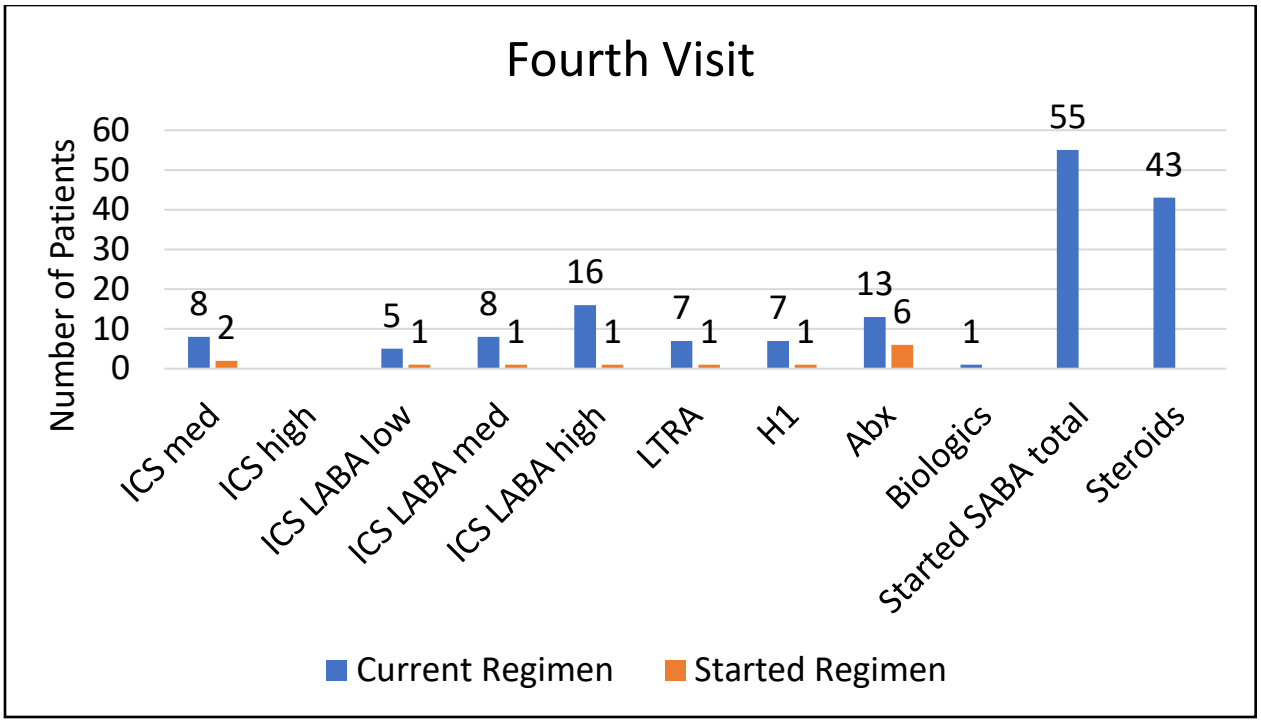

Figure 9. Medications summary after the fourth appointment. 55 patients were included. Current regimen indicates that the medications were "continued" or "refilled." Started regimen indicates that the medication was started at that visit.

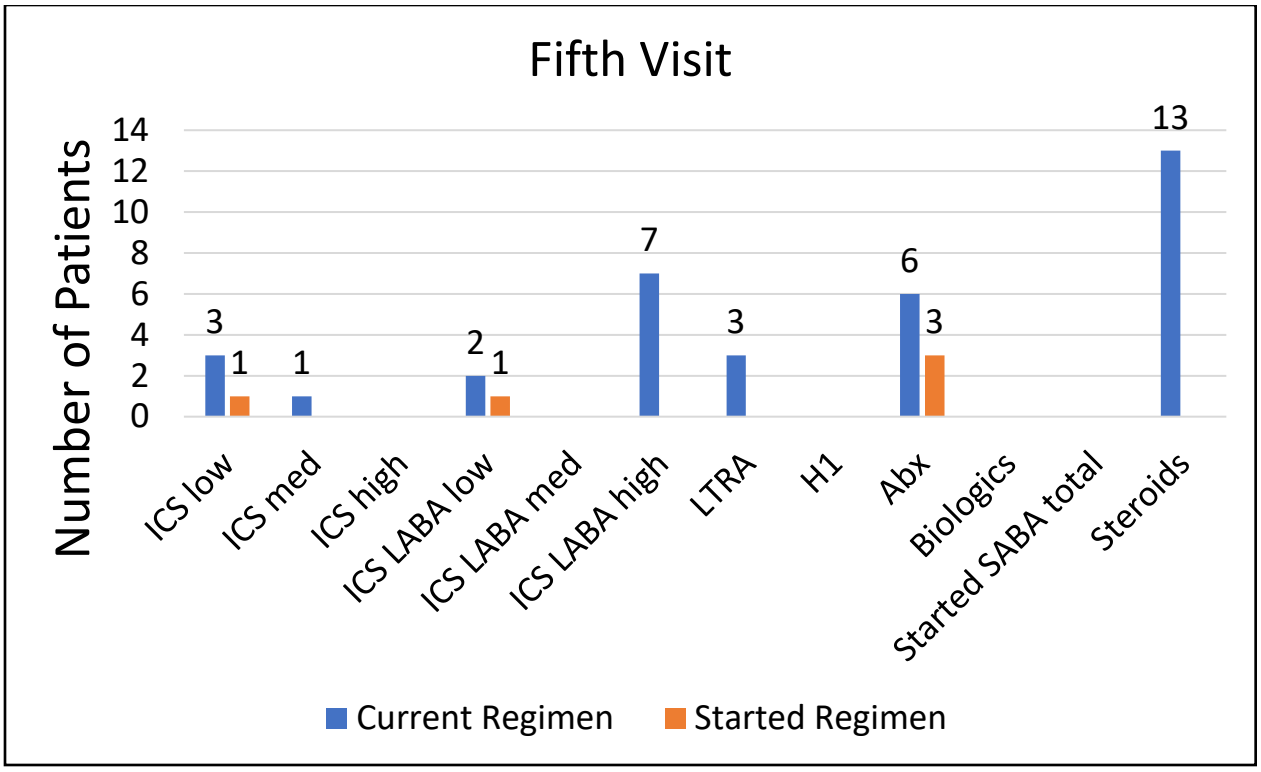

Figure 10. Medications summary after the fifth appointment. 15 patients were included. Current regimen indicates that the medications were "continued" or "refilled." Started regimen indicates that the medication was started at that visit.

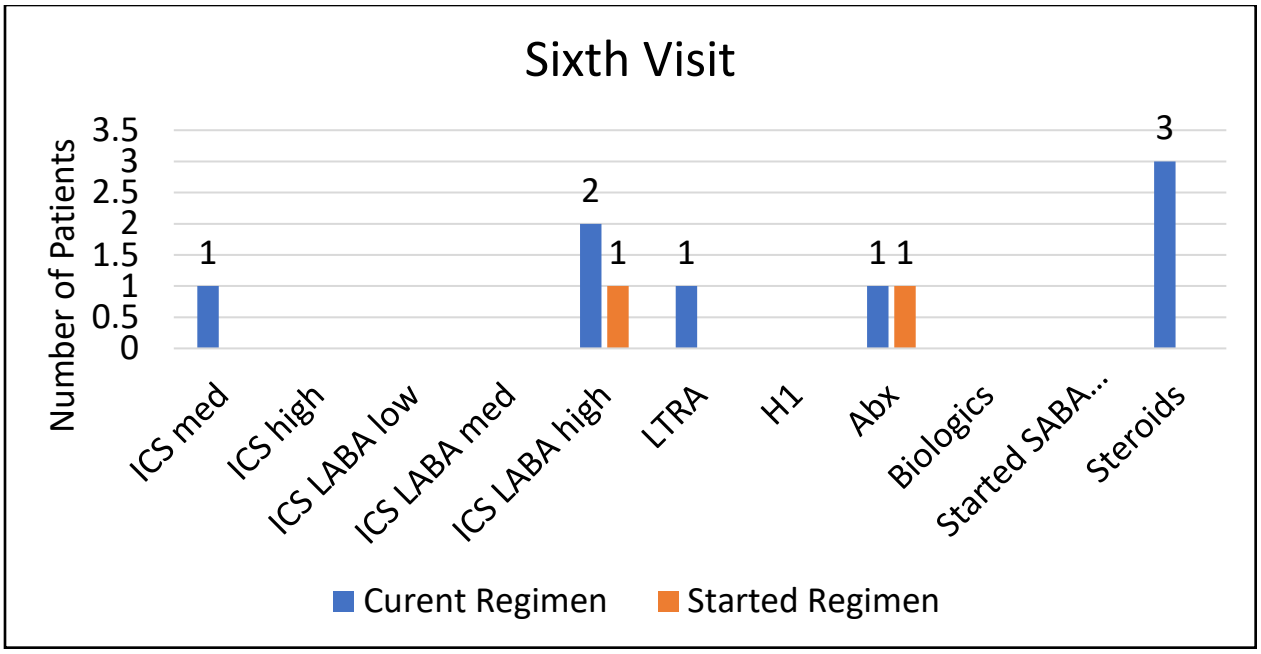

Figure 11. Medications summary after the fifth appointment. 4 patients were included. Current regimen indicates that the medications were "continued" or "refilled." Started regimen indicates that the medication was started at that visit. There was only 1 patient with 7 visits. This patient received refills for their ICS LABA High, SABA, and oral steroids.

The third research question investigated the role of specialty care in pediatric asthma outcomes. 179 individual patients participated in PFT testing. The number of appointments between the first and last appointment varied as well as the length of time between the first and last appointment. 89 patients had one or more appointments between the first and last visit. The average length between the first and last appointment was 145 days. From the original 352 patients, 165 patients were ineligible for PFT testing based on their age and 8 patients underwent exercise challenge tests (ECT) instead of PFT testing. Therefore, 173 patients were excluded from the analysis. When comparing the FEV_1 of initial visits to FEV_1 of last visits the p-value is 0.038, which is statistically significant.

Table 5

PFT Analysis

	Minimum (%)	Maximum (%)	Mean	Std. deviation
FEV_1 of initial visit	31	141	90.429	18.649
FEV_1 of last visit	47	136	94.206	16.566

Note. Sample size of 179 patients. P-value is 0.038, which is statistically significant.

Conclusion

A sample size of 352 patients was chart audited in order to understand further the role of specialty care in the pediatric asthmatic population in Minnesota. The majority, 67%, of the patients who presented to specialty care were referred by a PCP. Regarding medication changes, 52% of patients had modifications made to controller medications during the initial appointment. There was also a statistically significant increase in FEV_1 percentages when the initial visit and the last visit were compared. The data found from the chart review is compared to previously established literature and discussed further in Chapter 5: Discussion.

Chapter 5: Discussion

Introduction

As pediatric asthma remains a prevalent, costly, and life-limiting disease, it is imperative that medical providers be familiar with effective treatment options. Disease management may require incorporating a pulmonary specialty care clinic with practitioners who are knowledgeable of the most current treatment guidelines and interventions. The purpose of this study sought to retrospectively analyze a specific pediatric asthma specialty care clinic in Minnesota during January 2018 through December 2018 and identify the most common referral sources, types of medication utilized, and subsequent patient outcomes. This final chapter provided conclusions based on the purpose of the study, proposed research questions, and the corresponding findings as recorded in Chapter 4: Results. Additionally, the included discussion addressed the limitations encountered when gathering and analyzing the patient data as well as areas of future research to which this study may contribute.

Summary of Results

When completing this study consisting of an in-depth chart review of a Minnesota-based pediatric asthmatic clinic, the initial research question focused primarily on the referral sources leading to specialty care consultation. As discussed in Chapter 2: Literature review, the parents of pediatric asthmatics are typically interested in being followed by a specialty provider for asthma management (Pade et al., 2019). Despite meeting the qualifying criteria for consultation, patients may or may not be referred for specialty care management depending on the primary care provider's perceived clinical need and initiative (Pade et al., 2019). This finding correlated well with our study results, which demonstrated that the most common referral source leading to specialty care evaluation came from the patient's primary care provider (67%). Other less

common sources were seen in patients presenting after an acute asthma exacerbation leading to a referral established as a part of the hospitalization discharge process (25%) or those stemming from a self-referral made by parents on behalf of their child (8%). Together, the results of this study, as well as those of the existing literature, could be used to support increased education of primary care providers on the specialty care referral process, which could ultimately improve patient satisfaction and disease management.

The second question inquired about the interventions utilized by specialty care. New guidelines put forth in 2019 recommended that every patient diagnosed with asthma begin treatment using a rescue inhaler, SABA, with the optional addition of using an ICS controller inhaler (*Global Initiative for Asthma, 2019).* For the patients seen by specialty care, 17% of individuals were started on a SABA (Figure 6). By the second visit, 99% of patients were on a rescue inhaler (Figure 7). Therefore, specialty care management helped to ensure patients have the proper tools for managing acute asthma attacks. During the first visit, changes to controller medication were made in 52% patients either with the addition of a controller medication or modifying the intensity of the controller medication to the appropriate level based on the clinical picture and corresponding lab values (Figure 6). 27% of patients were started on either a chronic antibiotic, LTRA, or an antihistamine during the first visit, adding additional coverage for optimal control (Figure 6). Finally, rescue steroids were added to 51% of patient's asthma treatment plans at the initial visit (Figure 6). This addition allowed parents to have access to another tool for managing asthma exacerbations at home with the hopes of decreasing ED visits and hospital admissions.

The final research question investigated how clinical outcomes change during the course of specialty management. FEV_1 values helped to determine the amount of obstruction present in

the lungs, with the higher percentages representing less obstruction and disease burden (Sawicki & Haver, 2018). The average of FEV_1 upon initial visit was 90% and improved up to an average of 94% on the last visit of 2018 (Table 5). This change in value was statistically significant and indicated that specialty care management effectively improved pediatric asthmatic care outcomes. While there was no published source establishing the validity of specialty care management, this study and others like it may one day contribute to solidifying its role as a cornerstone for improving patient outcomes of the pediatric asthmatic population.

Limitations

As considered in Chapter 3: Methods, the anticipated study limitations arose in analyzing the patient data collection and the inability to control for patient compliance of the recommended treatment options when receiving specialty care management. Additionally, the study could not account for the pediatric patients' management before coming into the specialty care clinic or the period of time in between appointments. The collected data did not indicate the specific visit type for each session which also could contribute to result limitations. For example, a patient could have been seen for a routine scheduled visit or could have presented as a "sick visit" during a time of symptom exacerbation, likely leading to poor PFT value recordings.

Furthermore, the data did not incorporate demographic statistics such as gender, age, or socioeconomic status; therefore, comparisons between those variables could not be concluded. These unaccounted variables, in turn, may have impacted medication compliance or availability of treatment options which could ultimately skew patient outcomes. Lastly, the study collected patient data from patients seen in the specialty care clinic from January 2018 through December 2018. Since that time, new asthma management guidelines have been published which may no

longer correspond with the recommended treatment strategies during the predetermined timeframe.

Further Research

This study has contributed to understanding how one specialty care clinic influenced pediatric asthmatic patient outcomes during January 2018 through December 2018. Further research could feature other asthma clinics in various locations or gather patient data over a longer timeframe than was used in this study. Ideally, future studies could incorporate the most recent asthma management guidelines when analyzing patient data and corresponding outcomes. Other areas of research could include analyzing emergency department visits and hospitalization rates while being managed by specialty care.

Conclusion

The purpose of this retrospective cohort study was to review patient healthcare records and explore the impact of specialty care consultation for pediatric asthmatic management. Primary care providers will ultimately benefit from this research and that of the previously established literature. There was a direct correlation between families desiring to be evaluated by specialty care providers and the most common referral source stemming from the general practitioner's encouragement. This study contributed to the knowledge and understanding of the various interventions seen in pediatric asthmatic management. Specialty care providers are informed of the most recent diagnostic and treatment guidelines and incorporate the most effective medication regimens for optimal asthma control. This knowledge, in turn, has the potential to decrease acute asthma exacerbations, thereby reducing ED visits and hospitalizations. Lastly, the results of this study suggested a statistically significant improvement in patient outcomes when under specialty care services. While pediatric asthma remains a

potentially challenging illness to treat, this study sought to illustrate the impact of specialty care management on patient outcomes representing an overall improved quality of life. Hopefully, providers and patient families alike can use this research to live happier, feel healthier, and breathe easier.

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Appendices

Appendix A: Consent Form

General Consent

Consent to Treat
I consent to and authorize the physicians, nurses and other healthcare providers at Children's Respiratory & Critical Care Specialists, P.A. ('CRCCS') to perform appropriate healthcare examinations, treatment, diagnostic testing or medication administration as deemed medically necessary by their professional judgment. I know that there are some risks with all medical treatments and procedures and I understand that no one can guarantee how well treatments or procedures will work.

CRCCS is a teaching clinic. In addition to my clinician and other medical support staff, I may receive care from people who are in training. They are supervised by licensed health care providers. I may decline to have these individuals involved in my care and this will not affect my care or treatment.

Assignment of Benefits/Payment for Services
I authorize payment of any and all benefits to CRCCS. I know that I must pay for any charges for my care that are not covered by my insurance, health plan, or government programs. I realize I must cooperate with CRCCS to get payment for my care. If I am eligible for payment from more than one type of coverage, CRCCS will return any extra payments to the payor. If I have an unpaid bill at CRCCS, any refunds due to me will be put on my unpaid bill. If there is money left over after my bill is paid, I will get a refund from CRCCS.

Release of Information for Treatment, Payment and Health Care Operations
I consent to and authorize CRCCS to use and disclose my protected health information for **treatment, payment** and **healthcare operation purposes,** including care coordination and quality assessment and improvement activities. Releases for these purposes may be made to insurance companies, health plans, government programs, e-prescriber databases, payer network organizations, including clinically integrated networks and/or accountable care organizations in which my provider participates, and other healthcare providers involved in my care and treatment. Additionally, I consent to and authorize my insurance company to share my protected health information for the purposes stated above to CRCCS or a clinically integrated network or accountable care organization in which CRCCS participates.

Release of Information for Research Purposes
I consent to and authorize the release of my protected health information for medical and scientific research purposes.

Patient Rights and Privacy Practices
You and your family's rights and our privacy practices are posted in main areas within CRCCS. Your signature acknowledges receipt of our Notice of Privacy Practices. If you have any questions concerning your rights and/or our privacy practices, please contact your care provider or CRCCS's Privacy Officer.

Other Individuals Authorized to Consent to Treatment
In addition to the legal guardians of the patient, the following persons are authorized to consent to recommended medical care for my child: Name and relationship to patient (e.g., grandparent, daycare provider, etc.):

Name:	**Relationship to child:**
1._____	_____
2._____	_____

Mobile Phone Consent
Yes, CRCCS may call my provided mobile phone number about the care, treatment, services and accounts using pre-recorded messages, automatic telephone dialing systems and/or text messages. Standard text message and minute usage rates may apply. I am aware information in a voice or text message may not be secure and that providing this consent is not a condition of receiving treatment.

My signature here means I have read this information and understand it. This consent is valid until revoked in writing.

Print Patient Name: _____ **Date:** _____

Patient/Parent/Guardian Signature: _____ **Relationship to Patient:** _____

Name of Interpreter (if used): _____ **Telephone consent obtained by (Name/Date/Title):** _____

Children's Respiratory & Critical Care Specialists PA

Appendix B: Authorization

Jamie Stamm Inbox - Bethel 8:05 AM JS

Research Permission

To: Rachel Nornes, Marissa Wacker

To Whom It May Concern,

On behalf of Children's Respiratory & Critical Care Specialists (CRCCS), I, Jamie Stamm, give permission to Bethel University Physician Assistant students, Marissa Hall and Rachel Nornes, to conduct their Master's Research at this clinic with permission being granted for CRCCS patients to be chart reviewed.

Please feel free to contact me with any questions or concerns,

Jamie Stamm _ Manager, Healthcare ITS _ 612.813.3302
Children's Respiratory & Critical Care Specialists