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An Interdisciplinary Education and Service Bundle to Reduce Hospital Resource Utilization and Decrease Pediatric Asthma-Related Morbidity and Mortality

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by

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Dedication

I dedicate this Doctor of Nursing Practice project to the pediatric nurses at Newark Beth Israel Medical Center Children's Hospital of New Jersey. They are unsung heroes who work tirelessly to provide the best care to our most vulnerable patients. Asthma is extremely prevalent in Newark, NJ and our pediatric nurses saw an opportunity to improve care delivery to children and families affected by asthma and I owe all the success of this project to them.

Acknowledgements

I would like to thank Dr. Meena Kalyanaraman, the Associate Director of Pediatric Critical Care Medicine, for her mentorship and guidance throughout this project. Dr. Meena is passionate about Quality Improvement work and has been instrumental in getting this project off the ground. Dr. Meena does not take "no" for an answer. She breaks down walls and barriers to get the job done and it is truly inspiring to see just how far she is willing to go to improve patient care delivery. With her guidance, I was able to navigate the challenges of working with an interdisciplinary team, an unprecedented respiratory surge that nearly crippled this project, and a constantly changing workforce. She understands that QI is a long-term commitment and helped our team stay the course.

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Without the help of these two powerful, strong, and relentless women, this project would not have the far-reaching impact that it does.

Thank you to Dr. Moira Kendra who took the time to read this paper and helped support the final leg of the incredible journey to become a Doctor of Nursing Practice.

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Abstract

The purpose of this quality improvement project was to reduce hospital resource utilization and improve health outcomes for children with asthma by providing an evidence-based, interdisciplinary education and service bundle to patients and families admitted to a Children's Hospital in Northern New Jersey with a primary diagnosis of asthma. The 2020 Asthma Management Guidelines published by the U.S. Department of Health and Human Services (2020), the Global Initiative for Asthma (GINA) and a modified systematic review identified common themes among children at risk for asthma-related morbidity and mortality and high hospital resource utilization. These themes included medication misuse, asthma trigger misidentification, lack of awareness of signs and symptoms of an asthma attack, modifiable and non-modifiable environmental risk factors, and social determinants of health. The literature also highlighted the importance of standardizing education provided to patients and families during their inpatient stay. Use of a bundle that incorporates standardized, evidence-based education and individualized care planning to address social determinants of health may help decrease hospital resource utilization and improve overall health outcomes for children with asthma.

I. Background

Scope of the Problem

Asthma is a chronic inflammatory disease of the airways characterized by airway hyperresponsiveness, acute and chronic bronchoconstriction, airway edema, and mucus plugging. Asthma is the leading chronic disease in children in the United States. It is the third leading cause of hospitalizations among children less than 18 years old and is the leading cause of school absenteeism (Perry et al., 2018).

Asthma exacerbations can lead to substantial healthcare resource use and cost if not controlled or managed properly (Correa-Agudelo et al., 2022). According to Perry et al. (2018), children with asthma age 0-17 years had higher rates of physician office visits, hospital outpatient visits, and Emergency Department (ED) visits, than adults age 18 and over.
In 2018, Perry, et al found that the total direct cost of pediatric asthma was approximately $6.31 billion with outpatient visits and pharmacy utilization being the greatest contributors to the financial burden of asthma with acute care visits and ED visits following closely behind.

Black and Hispanic children have increased incidence of asthma and an earlier onset of asthma compared to White children due to neighborhood characteristics at birth including higher population density, and poverty (Malleske et al., 2022; Zanobetti et al., 2022). Length and cost of asthma-related hospitalization increases with worsening neighborhood deprivation (Tyris et al., 2022). Racial disparities in asthma-related hospital resource utilization are mediated by social, economic, and environmental factors. Living in urban areas with low socioeconomic status is a risk factor for childhood asthma morbidity, and neighborhoods with high social vulnerability levels result in environmental triggers affecting Pediatric Intensive Care Unit admissions for asthma (Correa-Agudelo et al., 2022).

Asthma-related morbidity and mortality for children in an inner city in northern New Jersey are disproportionately higher than the norm, due to the substantial disparities in social and health determinants and in healthcare. One in four children in this city has asthma (U.S. General Services Administration, n.d.). The rate of hospitalization is 150% greater for children living in this city compared to the rest of New Jersey, and more than thirty times the nationwide rate (Rivlin-Nadler, 2016). Although asthma-related deaths are rare in children, this city experienced an average of one death a year from 2010 to 2017, according to the New Jersey Department of Health (Bose, 2019).

Residents of this city are exposed to numerous asthma triggers including exposure to multiple air pollutants and the effects of chronic stress that result from social determinants of health. The Ironbound section of this city is bordered by six major highways, two rail lines, a large international airport, and Ports of Newark and Elizabeth, subjecting residents to toxic levels of air pollution linked to increased rates of asthma and other health conditions (Laumbach, 2011). While causes of asthma are multifactorial, research has pinpointed traffic pollution as one of the underlying causes, not just a trigger for exacerbations (Menon, 2022). In this city, asthma is the leading cause of school absenteeism and air pollution levels are measured highest between 7:30am and 8:30 am when children are on their way to school (Rivlin-Nadler, 2018).

Purpose of the Project

Effective management of pediatric asthma is complex and patient and caregiver knowledge are essential to optimize the quality and safety of the child's asthma care. The overall goal of pediatric asthma management is to reduce morbidity and mortality, maximize optimum growth and development including participating in age-appropriate physical and social activities, and decrease school absenteeism. To accomplish this goal, the health care team must identify

gaps and needs in caregiver's knowledge and provide the necessary education and resources for home management strategies (Jordan et al., 2022).

In 2021, a cluster of children admitted to the Pediatric Intensive Care Unit (PICU) in a Children's Hospital in northern New Jersey suffered significant morbidity from asthma exacerbations at home and two children died from cardiac arrest secondary to an asthma attack at home. These cases demonstrate the importance of using individualized Asthma Action Plans (AAP) to guide home interventions when asthma symptoms arise. Children and caregivers must receive ongoing education on their AAP so that they understand when and how to use their short-acting beta agonist (SABA) medications, also known as "rescue" medications for acute symptom relief, and when and how to use their long-acting corticosteroid (ICS) "controller" medication to reduce the number of asthma exacerbations (Jordan et al., 2022).

Elements of effective and comprehensive asthma care include initiating education early in the hospital stay to allow for repetition of teaching points, use of bedside demonstration, and allowing time for the child and caregiver to ask questions about their care plan. Every encounter with a member of the healthcare team represents a teachable moment. Topics to be reviewed include asthma pathophysiology, symptoms and triggers of an asthma attack, use of "rescue" and "controller" medications, initial interventions for asthma attacks, lifestyle changes to mitigate modifiable risk factors (smoking cessation, etc.), AAPs and other home management strategies (Jordan et al., 2022). Knowing that severe asthma exacerbations and status asthmaticus are largely preventable with comprehensive asthma care which includes structured asthma education to increase self-management and self-efficacy, the interdisciplinary team acted swiftly to identify gaps in our practice that could be contributing to these catastrophic events (Ibrahim et al., 2019).

Current Practice

When evaluating the practices and processes of caring for children admitted to either the Inpatient Pediatrics (IP) ward or the Pediatric Intensive Care Unit (PICU), there were many opportunities to improve care delivery. Asthma care requires the coordination of multiple disciplines including nursing, medical providers and respiratory therapy (RT). The healthcare team did not have a standardized method for providing asthma care and as such, missed many of the key elements of comprehensive care necessary to optimize both asthma-related health outcomes and quality of life.

Daily leadership rounds were conducted on the IP ward and PICU by unit-based managers and departmental directors. The purpose of these rounds was to have the opportunity to connect with patients and caregivers and address any issues that may arise during their hospital stay. During these rounds, patients and caregivers often reported they were receiving inconsistent information from Physicians, Nurses, and RT; specifically noting varying methods used to teach them how to administer their asthma medications via their Metered Dose Inhaler (MDI) and the use of a spacer device. These inconsistencies were reported among families admitted to and discharged from the same unit and those transferred from the PICU to IP ward and vice versa.

Inhaler misuse is highly prevalent and associated with high morbidity. A cross-sectional study by Almomani et al. (2021) showed that of the 150 patients included in their study to evaluate proper inhaler technique, only 13.4% of participants used their MDI correctly. Recent global position documents from the GINA and the Global Initiative for Chronic Obstructive Lung Disease (GOLD) both give significant prominence to assessing and correcting incorrect inhaler technique before considering escalating drug therapy (Usmani et al., 2018).

Despite the risks associated with MDI and spacer misuse, processes for evaluating the child and family's technique when administering their medication by MDI and spacer were not in place for children newly diagnosed with asthma and children with a pre-existing diagnosis of asthma admitted to our facility.

Children with asthma who use an MDI without a spacer device gain little to no clinical benefit from their medication as much of the medication is deposited in the oral cavity and not delivered to the lungs. Spacers are reservoirs that separate the MDI from the patient's mouth to keep the medication suspended in the air allowing for slow inhalation of medication. These devices were developed to allow for more effective MDI medication delivery to the lungs and reduce oral deposition where it serves no clinical benefit. Spacers can be used with or without a face mask depending on a child's developmental level or personal preference. Masks are typically used on spacers for children age 5 and younger whereas older children favor use of the mouthpiece. However, the technique when using the spacer with a face mask is different than the technique when using the mouthpiece, which can cause confusion and contribute to inhaler misuse, further highlighting the importance of this educational topic (Volerman 2020).

Many MDI canisters have dose counters to accurately track the amount of medication remaining in the inhaler measured by the number of puffs remaining. Determining when an inhaler is empty is challenging because some propellant remains in the canister after all the medication has been used and can falsely give the impression that there is medication remaining (Moore, 2022). In a study by Fullwood et al. (2022), 73.5% of the patients sampled deemed an empty inhaler as either full or partially full. MDI medication has the potential to save the life of a patient experiencing an asthma exacerbation, but only when it is being used properly. Patients

and children must receive appropriate guidance on how to identify when an MDI is empty, which was not part of the asthma education provided in our facility.

Medical Providers

Attending physicians and residents used a generic admission and discharge document in the Electronic Medical Record (EMR) for all IP and PICU admissions. These documents did not have disease-specific prompts or cues for providers to use to guide their interventions. Without these disease-specific prompts, physicians were reliant on their own clinical acumen to order asthma-related interventions, create an asthma action plan, provide disease-specific education, help identify symptoms and triggers of an asthma exacerbation and to provide community-based resources to patients and families to use once discharged.

AAPs are a set of written instructions for patients and caregivers to follow in their day-to-day management, as their asthma worsens, or in the event of exacerbation. AAPs are designed to be clear and practical sets of instructions with eye-catching and distinct features to facilitate understanding and compliance with use. AAPs use a traffic light analogy which employs three "zones" ranging from green (absence of signs and symptoms) to yellow (mild to moderate symptoms present) to red (severe symptoms with specific instructions to use their SABA medication and to seek immediate medical attention), (Pegoraro et al., 2022). Providers were responsible for completing an AAP for each patient to provide individualized interventions to relieve asthma symptoms at home, and to instruct them when to seek medical attention.

The medical team previously was using a non-standard, resident-created version of the AAP with multiple pages rather than using a one-page, succinct and easy-to-read document. Though the multi-page document did use a traffic light analogy, it was printed in black and white which didn't allow for the green, yellow and red zones to be easily identified. At the time of

discharge, AAP documents were occasionally found to be incomplete, omitting information like dosages for medications. Additionally, AAPs were often not completed until the day of discharge which did not allow sufficient time for providers and nurses to review the content with the patient and family to ensure they understood their home management plan.

To better understand the current state of AAP completion and to assess how often patients and caregivers received bedside education about how and when to use their AAP, the APN-leader conducted a retrospective review of ten randomly selected charts per month from October 1, 2021, through March 31, 2022. This review revealed that AAPs were complete only 31% of the time and patients and families received education about how and when to use their AAP only 63% of the time.

In addition to using a SABA (i.e. albuterol), or "rescue" medication for acute symptom relief, children with a history of asthma may be prescribed an ICS (i.e. Flovent), often referred to as a "controller" to be taken daily to help reduce inflammation and reduce the risk of severe asthma exacerbations (Levy et al., 2023). As both "rescue" and "controller" medications can come in MDI formulation, ICS can easily be confused with a SABA. Distinguishing between these two medications was not a standardized part of medication teaching.

Children admitted to the PICU for status asthmaticus, an emergent episode of acute asthma exacerbation that poorly responds to standard therapeutic measures, were placed on continuous nebulized albuterol for bronchodilation (Chakraborty & Basnet, 2022). As clinical status improved, children were weaned from continuous albuterol to intermittent albuterol treatments via small volume nebulizer every 2 hours. Having patients continue to receive albuterol via nebulizer was clinically unnecessary, as albuterol delivered via MDI and spacer has equal, if not better aerosol delivery and clinical efficacy (Alhaider et al., 2014). Use of a

nebulizer also limited the patient and caregiver's exposure to the MDI and spacer and thereby missing critical opportunities to provide education on the medication delivery device they would be using at home upon discharge. Using albuterol via MDI and spacer is not only equally effective to the nebulized formulation but it is also more portable, easier to use, has fewer side effects, is more cost effective and has higher parent and child satisfaction according to many studies (Nambier et al., 2018). According to Alhaider et al. (2014), use of a nebulizer as the primary medication delivery device for asthma care requires additional resources in terms of cost and human resources because a respiratory therapist is often required to supervise the patient during treatments. The authors concluded that conversion to MDI and spacer for inhaled bronchodilators and corticosteroids led to a reduction in resource utilization by decreasing treatment preparation and medication delivery time and enabled early, independent administration by patients and caregivers in addition to a potential reduction in medication cost.

Patients with asthma were inconsistently transitioned directly from continuous albuterol via nebulization to an MDI and spacer. The long-standing practice was to wean nebulized albuterol treatments to every three hours once the patient was clinically stable, at which time they were transitioned to MDI and spacer and transferred to the IP ward for the duration of their hospital stay. Patients met criteria for discharge once they exhibited signs of clinical stability (no wheezing, no signs of respiratory distress, vital signs within normal range, and oxygen saturations within normal range) while receiving albuterol via MDI and spacer every 4 hours for a total of three treatments at an every four-hour schedule.

Nursing

Asthma education is paramount to safe patient discharge and optimal health outcomes outside of hospital care (Jordan et al., 2022). Nurses were documenting the education they

provided to patients and caregivers on a generic education template in the patient's EMR. Unless the nurse commented on the specific educational content reviewed, it was difficult to determine what, if any, asthma-specific information was provided. To assess the current state of asthma-specific nursing education, the APN-leader conducted a retrospective review of ten randomly selected charts per month from October 1, 2021, through March 31, 2022, which showed that asthma-specific education was only being documented for 22% of patients reviewed.

Respiratory Therapy (RT)

Once a patient was clinically stable and well enough to wean albuterol treatments to an every 3-hour frequency, they were transitioned to an MDI and spacer. RT was responsible for providing the initial demonstration of the MDI and spacer technique with the patient and caregiver using either the face mask or mouthpiece depending on patient age and/or preference. This education was documented in the RT education section of the EMR with once completed. After the first dose education, RTs in the PICU provided ongoing ad hoc education and support to patients using an MDI and spacer, though this was a shared responsibility between RT and nurses. The APN-leader received anecdotal information that patients and caregivers reported varying techniques used by RTs and nurses, leading to confusion and potential medication misuse.

RT-led MDI and spacer education was limited to the first dose for patients in the PICU and not the IP ward. Though the same RT team rounded in both the IP ward and PICU, there were two different standards between patients admitted to the IP ward and those admitted to PICU, and the inconsistent practices led to confusion among nurses and RTs as to who was primarily responsible for the education.

Community Health Worker (CHW)

A CHW was hired as a grant appointed position with the primary responsibility of bridging the gap between children hospitalized for chronic illnesses and the school setting. A critical role of the CHW is to screen for Social Determinants of Health (SDH) which are the conditions in the environments where people are born, live, learn, work, play, worship and age that affect health, functioning and quality of life (Healthy People 2030, n.d.). SDH are major drivers of health outcomes and health inequities among children and adults and may play a much larger role in determining health outcomes than health care. Adverse SDHs are significantly associated with increased risk for pediatric asthma morbidity. Specifically, decreased educational attainment was significantly associated with increased risk for both ED encounters and hospitalizations (Tyris et al., 2022).

Children living in this inner city in Northern New Jersey are disproportionately affected by asthma as compared to children in the rest of the state. Though there are non-modifiable risk factors for asthma development, a CHW can provide asthma education, help patients and families address modifiable risk factors such as trigger abatement (i.e., mold removal, extermination, air filtration), and to screen for the social determinants of health that may affect health outcomes. Prior to project initiation, the CHW was being consulted only 22% of the time according to a retrospective chart review conducted by the APN-leader for the 6-month period preceding this quality improvement project's implementation.

Pharmacy

A meds-to-beds program in which medications are filled in the hospital pharmacy and brought to the patient's bedside before discharge, eases the transition from hospital to home and decrease the burden on caregivers to obtain medications after they are discharged (Findlater et al., 2022). Meds-to-beds services were widely used in the adult inpatient units but had yet to be

used in the Children's Hospital. Meds-to-beds services had the capacity to provide asthma medication to the patients and families from the hospital pharmacy prior to their discharge. This service would help ensure that there would be no barriers to obtaining the medication and to make certain the medication will be administered on time after the patient leaves hospital care.

Description of the Project

This Quality Improvement (QI) project was designed to be used for all children and caregivers admitted to the Children's Hospital with a primary diagnosis of asthma by a pulmonologist or hospitalist. Each patient received a standardized, evidence-based education and service bundle to equip them with the information and resources needed to safely assume asthma-related care at home to optimize health outcomes, reduce asthma-related morbidity and mortality, and decrease the need for hospital resources.

Education was provided by Nurses, Providers, and Respiratory Therapy using a standardized educational booklet, available in both English and Spanish. Booklets included both printed and video-based education to accommodate various learning needs and ensure consistent messaging. All asthma-related education was documented in designated sections of the EMR which includes the asthma discharge template completed by providers. Service bundle elements including social determinants of health screening and meds-to-beds services was provided by a CHW and Pharmacist respectively. The CHW and meds-to-beds pharmacist were notified of an asthma-related admission through secure text messaging on hospital phones. Consultations from the CHW and meds-to-beds pharmacist were documented in a progress note in the EMR and noted in the asthma discharge template.

Objectives

This QI project has two outcomes and these include 1.) decreasing asthma related morbidity and mortality; and 2.) decreasing hospital utilization of resources. The primary objective of decreasing morbidity and mortality from 2021 to 2023 by providing evidence-based interventions shown to improve health outcomes and decrease hospital resource utilization. The second objective included the implementation of an asthma-specific bundle aimed at delivering standardized patient and caregiver education. A service bundle was simultaneously implemented during the hospitalization to provide the patient and caregiver with the resources necessary to identify and address social determinants of health services including primary care and outpatient services and completed by the time of discharge.

The "standardized, evidence-based asthma education bundle" was defined as having documentation in the electronic medical record (EMR) of a review of asthma pathophysiology, symptoms of an asthma exacerbation, triggers that may precipitate an asthma exacerbation, use of the Metered Dose Inhaler (MDI) and spacer, rescue medication (SABA) versus controller medication (ICS), and a review of the patient's own asthma action plan. The "service bundle" was defined as having a consultation with the CHW, through which a social determinants of health screening was conducted, a follow-up appointment with a primary care physician and/or pulmonologist was made, and a meds-to-beds service consultation was placed for the patient and family to have their prescriptions at the bedside for education and review prior to discharge. These specific interventions were essential components to address the social determinants of health for children with asthma. A secondary objective was to decrease hospital resource utilization by decreasing the length of stay in the PICU with use of the evidence-based education and service bundle.

To meet the above objectives, the PICU and IP teams provided individualized self-management patient and caregiver asthma education at the bedside. Education was completed by a multidisciplinary team including nurses, Respiratory Therapists, medical residents, attending physicians, a CHW and pharmacists using the standardized educational booklet to review each asthma-related topic. The primary objective for both the IP ward and PICU was to educate 80% of the patients admitted with a primary diagnosis of asthma from April 1, 2022 to March 30, 2023. A secondary objective was to implement bundled services to 80% of the patients admitted with a primary diagnosis of asthma to the IP ward and PICU from April 1, 2022 through March 30, 2023.

Significance for Nursing

Nurses working in the IP ward and PICU felt significant moral distress related to the devastating asthma-related outcomes suffered by children and their families in 2021. This QI project empowered nurses and allowed them the opportunity to play an active and integral role in improving asthma care delivery. To improve health outcomes in children with chronic conditions like asthma, it is critical to promote self-care and self-management through education and support. Nurses are uniquely positioned to establish caring relationships and encourage self-care behaviors including daily activities to achieve a healthy lifestyle, adhere to prescribed medical treatments, monitor clinical parameters, symptoms and evaluate risk factors for optimal health, and to safely manage acute events or emergency situations (Dall'Oglio et al., 2021).

II. Review of the Literature

Theoretical Framework

Dorothea Orem's Self-Care Deficit Nursing Theory (SCDNT) was the theoretical framework that best represents the focus of this project. Orem believed humans can take deliberate action for regulating life, health, and well-being. A self-care deficit exists when a person's ability to carry out required action is not adequate to meet all, or part of the total need for self-care (Cox & Taylor, 2005). Self-care requisites include the actions and items necessary for a person to achieve holistic self-care including health, development, and general well-being (Yip, 2021).

Self-care agency is the person's overall ability to meet their self-care needs (Yip, 2021). Chronic illnesses often require major adjustments and adaptations in the life of the child and caregiver. Nurses provide holistic care which focuses on the entire life-circumstance and wellbeing of the person, not just the medical aspects of their illness. Nursing interventions for children affected by chronic conditions should focus on providing support to enhance their ability to manage their disease in everyday life (Hellqvist, 2021).

Critique of Empirical Studies Related to the Central Concept of the Project

A literature search was conducted to identify common risk factors for pediatric asthma-related hospital resource utilization (Emergency Department visits, inpatient admissions, and increased length of stay) using the following databases: PubMed, CINHAL and Google Scholar. Search terms included the phrases, 'pediatric asthma readmission," "pediatric asthma discharge," "pediatric asthma bundle," "pediatric asthma risk factors," "pediatric asthma length of stay," "pediatric asthma social determinants of health," and "pediatric asthma education." Articles were selected based on the relevance to addressing these risk factors.

Abstracts were reviewed to ensure the sample only included pediatric patients age 2-18

years with a primary diagnosis of asthma. Studies that included children less than 2 years of age were excluded because it is clinically challenging to establish a diagnosis of asthma in children of this age group as bronchiolitis and reactive airway disease present with symptoms similar to asthma so the risk for misclassification is high (Al Shamrani et al., 2021).

Studies including emergency department visits, inpatient hospitalizations and outpatient visits with a primary provider were included as this represents the continuum of care received by children with asthma and had the potential to increase the breadth of this project.

According to Parikh et al. (2018), there are currently no standardized asthma discharge processes across children's hospitals despite recommendations from the National Institutes of Health which states the importance of asthma education, medication education, and environmental mitigation. In their national sample of children's hospitals, the researchers found that asthma-specific discharge components were not being delivered consistently with the most common educational elements being MDI and spacer use and communication with the primary care doctor at discharge. The least common elements were providing medications in hand at the time of discharge and providing referrals for environmental trigger mitigation and home visit referrals. When they examined all discharge components individually, the researchers determined that the only single component shown to significantly reduce 3-month readmissions was having comprehensive content of asthma education.

Despite the lack of consistent practices, research has shown the benefit to standardizing asthma care. In a study by Bracken et al. (2021), asthma readmissions were reduced by standardizing the delivery of clinical care and patient education. Similarly, Johnson et al. (2020) found that standardized pediatric asthma care has been shown to improve quality of care and reduce healthcare costs.

Castillo et al. (2017) identified four essential components of asthma management: patient

education, monitoring of symptoms and lung function, control of triggering factors and co-morbid conditions, and pharmacologic therapy. Patient education on asthma decreased exacerbations and improved control.

Ng et al. (2006), conducted a prospective randomized, single blinded controlled trial which compared a standard asthma education program with an intensified program which included multimodal educational strategies and a phone call one week after discharge. Of the 100 patients enrolled, 45 were assigned to the standard program and 55 into the intensified program. The study showed a significant reduction in the number of visits to the ED ($p = .01$) and number of hospitalizations ($p = .01$) but no difference in the number of visits to the primary care provider for acute asthma ($p = .08$). Additionally, parents in the intensified program reported increased satisfaction ($p = .03$) and reported better compliance with their asthma action plan ($p = 0.029$) compared to the standard education group. Though this study is quite dated, and results were from a small sample size, the results strongly suggested that more extensive education has positive results on decreasing unnecessary hospital resource utilization.

Peterson-Sweeney et al. (2007) investigated the influence of asthma-related education provided by healthcare providers on parental asthma illness representation, including the parent/health care provider relationship. The researchers enrolled 228 families into the study and using three unvalidated tools (Parent Report of Asthma Education Received (PRAER), Asthma Illness Representation Scale (AIRS), and the Parent/Health Care Provider instrument) interviewed the families to obtain information regarding their beliefs on how well asthma education had been provided, attitudes towards symptoms and use of medications, and the parent/ health care provider interaction. Though the results of their study showed that asthma education provided in the health care setting positively affected illness representation of parents of children with asthma, improved attitudes toward use of anti-inflammatory medications for

asthma and improved overall knowledge of asthma pathophysiology, a limitation of their study was the difficulty in knowing what teaching the families actually received from their health care provider since all information was based on parent report. There were no measurements of the quality of education provided.

Coffman et al. (2008), conducted a meta-analysis to estimate the effects of pediatric asthma education on hospitalizations, ED visits, and urgent visits for children with asthma. The authors reviewed 37 studies which compared educational interventions to usual care and found that compared to usual care, pediatric asthma education is associated with decreased mean number of hospitalizations and ED visits and a trend toward decreased odds of an ED visit but did not affect the odds of hospitalization or mean number of urgent care visits. The researchers reported that generalizability of their findings may be limited to low-income households since three-quarters of the studies they reviewed sampled primarily low-income families. Additionally, they reported that their findings may overstate the effect of asthma education as the comparison to "usual care" lacks specificity.

A consistent finding among these studies was the emphasis on four major educational topics that should be addressed with patients and families: basic facts about asthma pathophysiology, correct usage of medication, early identification of symptoms, and the importance of avoiding triggers (Coffman et al., 2008; Parikh et al., 2018) By bundling these components, the nurses and other members of the healthcare team offer the opportunity for multiple points of contact with the patient and family to educate and plan for discharge while also planning for post-discharge care (Parikh et al., 2018).

Studies also represented how both inpatient and outpatient asthma-education and discharge planning led to a shift in care delivery (Ng et al., 2006; Peterson-Sweeney et al., 2007). These studies showed that educational interventions were associated with decreased ED and inpatient

hospital utilization while urgent visits to primary care providers increased. By shifting care delivery back to the primary care setting, patients and families can benefit from the continuity of care and establish a trusting relationship with their primary provider which would significantly reduce the need for inappropriate use of hospital resources.

Studies of severe asthma in the United States and other developed countries suggest that the Social Determinants of Health (SDH) impact health and heath care in at least 50% of children with asthma. Factors associated with increased asthma morbidity include poverty, poor housing, high levels of environmental pollution, second-hand smoke, allergen exposure, poor access to specialty care, exposure to high levels of stress and lack of community support. To understand causal pathways in asthma, environmental, socioeconomic, and psychosocial factors impacting asthma must be investigated (Federico et al., 2020).

III. Methods

Approval Process

Seton Hall's Internal Review Board (IRB) reviewed the project design and determined it did not meet the standards for review and thereby was exempt from IRB approval (see Appendix A). Dr. Mary Ellen Roberts, the Director of Seton Hall's Doctor of Nursing Practice program was supportive of this project from its inception. She approved the project design and allowed implementation to begin earlier than anticipated due to the critical nature of the clinical problem. Dr. Roberts has continued to provide support and mentorship during all phases of the project.

As there had been considerable asthma-related morbidity and mortality in our hospital, senior leadership was quick to support the project and lend assistance as needed. The Director of the Children's Hospital, the Director of Respiratory Therapy, the Director of Inpatient Pediatrics and the Director and Assistant Director of the PICU assembled members of their respective teams to lend support and resources to ensure project success. The support and advisement from hospital leadership has significantly contributed to the positive outcomes of this project.

Additional support and mentorship came from medical leadership from both the IP ward and PICU, particularly in light of the inconsistencies identified in clinical practice among all disciplines. Physician leaders had extensive experience leading QI projects and provided guidance and direction to maintain project momentum. The Chief Medical Residents were invested in project success and worked diligently to facilitate the practice changes that would improve patient care and patient outcomes.

Phase 1- Needs Assessment

A needs assessment (see Appendix B) solicited feedback from Nurses, Physicians and RTs to evaluate their level of comfort and proficiency with teaching asthma-related content and skills to patients and families. Results revealed consistently low levels of confidence and significant

person-to-person variation across all disciplines. Based on these results, targeted interventions and educational initiatives were developed to improve confidence and ensure consistency and standardization when teaching skills related to asthma care (i.e., MDI and spacer use, using the Asthma Action Plan).

SWOT Analysis

A SWOT analysis identified strengths, weaknesses, opportunities, and threats to project success. This analysis was used to formulate the initial Plan-Do-Study-Act (PDSA) cycles for the QI team to address weaknesses and opportunities that may impact the ability to achieve sustainability and achieve project related outcomes.

This project involved a coordinated effort among RNs, Respiratory Therapists (RT) and Medical Providers as each of these specialties was responsible for certain aspects of the project. This collaboration strengthened the project as all members shared ownership, were committed to learning from one another and meeting the needs of our patients and families.

Another strength was the strong sense of community-centeredness and team members were passionate about partnering with community-based resources and establishing relationships with outpatient services. In doing so, we can provide our patients and families with continuity of care and promote primary care services rather than relying on hospital-based services.

Weaknesses of this project stem from high staff turnover, inconsistent leadership, and lack of engagement in the post pandemic period. The current state of healthcare, particularly amid a pediatric respiratory surge, did not lend itself to increasing workload and responsibility. Nurses, RTs and medical residents were overwhelmed and disengaged from any work that was perceived to be burdensome. Though there was strong interest in the development of this project at first, designated champions soon disconnected from project work and removed themselves from the project team altogether. Without consistent nursing management, there is a lack of

accountability and less incentive to buy into the project and complete the necessary work.

Additional weaknesses include the lack of time and resources to teach the material needed to ensure delivery of the care bundle is standardized among three disciplines. Needs assessment results showed staff are inconsistently teaching critical educational elements, leading to confusion and potentially unsafe practice.

This project can make many positive changes at the unit, hospital, and community level. As 30-day readmissions are a major focus from both a cost and quality perspective, this project can save the hospital from penalties incurred from unnecessary use of hospital resources. Reducing asthma-related hospitalizations is also an objective of Healthy New Jersey (NJ DOH, 2022). We can best achieve this goal by partnering with both outpatient services and ED leadership to join forces and develop a more robust plan to reroute patients to primary care services.

Other opportunities include promoting professional development and fostering a sense of pride in quality improvement work. Hospital infrastructure lacks support of evidence-based practice and quality improvement work so this project will have the potential to help establish ourselves as an innovative team, leading the way for future QI and Evidence Based Practice work.

The biggest threat to the success of this project is lack of engagement as previously mentioned. It is difficult to maintain momentum despite strong leadership support. As pediatric services across the country recently experienced an unprecedented surge in admissions in 2022 and 2023, Nurses, RTs and residents are experiencing burnout and do not have the willingness and capacity to take on responsibilities outside of their daily clinical workload. Furthermore, our Community Health Worker was employed through a grant which expired in the Spring of 2022 and there are no plans to renew it. The CHW had been instrumental in connecting patients and

families with community-based resources and establishing primary care services. Now these responsibilities have fallen back on the already strained RN and resident teams.

A long-term threat to this project is the lack of resources available to meet the needs of a multi-cultural and multi-lingual patient population. Additionally, despite asking patient's and family's preferred learning style as part of the admission process, the only educational materials available are printed hand-outs with few video-based learning opportunities- only available in English.

Logic Model

As shown in Figure 1, a logic model was created to illustrate the shared relationships among project resources, activities, outputs, income, and impact (CDC, n.d.). This model served as a roadmap to guide initial project planning and to remain focused on reaching the project goals.

Phase II- Stakeholder Support

A literature review revealed that risk factors for unnecessary hospital resource utilization and negative health outcomes for patients with asthma involved the work of five distinct groups: Nursing, Physicians, Respiratory Therapy, a Community Health Worker, and Pharmacy and thus a team was formed comprising of clinicians from these disciplines, each lending their expertise to the development of project goals and objectives. Managers and Directors from each discipline expeditiously lent their support to the project and supported their staff in project work.

Phase III- Initial Implementation

To increase confidence and competence, Nurses, Physicians and RTs attended live classes during which the standardized educational content was thoroughly reviewed, and attendees had the opportunity to role play and demonstrate use of the MDI and spacer, their rescue medication, their controller medication and how to use their Asthma Action Plan using teach-back methodology.

A Computer Based Learning (CBL) module was assigned to all Nurses, Physicians and RTs which summarized the key content from the live in-services and served as an on-demand resource. This CBL will be reassigned to key clinical staff annually to maintain competency.

A standardized educational booklet was developed by the members of the QI team to serve as the one source of information and education to limit person-to-person variation when providing patient and family education. The booklet reviewed all topics the team deemed necessary for safe discharge. To ensure understanding, the educational material was written at a 5th grade reading level. For audio-visual learners, QR codes were used throughout the booklet to link to clinically reputable videos.

Before this project started, nurses documented their education on a generic checklist in the EMR. Any education pertaining to an asthma-related topic had to be free-texted, which was found to be burdensome and therefore it was difficult to determine what patients and families with asthma were being taught during their hospitalization.

A checklist using the acronym A-S-T-H-M-A (see Figure 2), used each letter in the acronym to stand for a particular teaching topic. “A” stood for “asthma basics” which reviewed basic asthma pathophysiology; “S” stood for “symptoms and triggers” of an asthma attack; “T” stood for medication administration using the MDI and spacer “technique”; “H” stood for home management; “M” stood for “medication” which reviewed the differences between rescue medications and controllers; “A” stood for “Asthma Action Plan” and reviewed the components of the patient’s individualized home treatment plan. Each teaching topic had a corresponding section of the educational booklet. The A-S-T-H-M-A checklist also served as a visual tool to help clinicians see the topics that had already been reviewed with a patient and family and those that had yet to be discussed. This checklist was used during shift-to-shift handoffs and unit-to-unit transfers to ensure continuity and reinforcement of education when needed. After discharge,

these checklists were saved in a folder at the unit secretary's desk for the APN leader to audit. Completed checklists were compared to the EMR generated list of patients admitted for asthma to ensure each patient received the necessary nursing education for safe discharge.

A retrospective chart review of children admitted with a primary diagnosis of asthma from October 1, 2021, through March 31, 2022, revealed many gaps in the care provided to patients and families with asthma. This review served as the baseline which also helped highlight critical issues that needed to be addressed to provide comprehensive asthma education and care.

Phase IV-Ongoing Implementation

Nursing Interventions

Nurses are responsible for providing a basic overview of the asthma disease process, counseling for trigger identification and management, and the signs and symptoms of an asthma exacerbation. Education is documented in the patient's electronic medical record (EMR) in an asthma-specific educational checklist designed for the EMR with the help of a Nurse Informaticist. The checklist mirrors the educational topics listed on the A-S-T-H-M-A paper checklist for continuity and standardization.

Medical Interventions

Medical providers from PICU and General Pediatrics are responsible for completing an Asthma Action Plan and providing ongoing education to the patient and family as to how and when to use their individual plan.

AAPs are organized into three zones reminiscent of a stoplight. The "green zone" provides instructions to take prescribed daily controller medications when applicable and information about symptom-free days. The "yellow zone" provides instructions for medical interventions when the child had mild to moderate symptoms of asthma exacerbation. The "red zone" provides instructions for immediate medical intervention as well as instructions for calling

911 and going to the Emergency Room.

When reviewing the components of the AAP, it is essential for the clinician to review the child's prescribed asthma medication and when to use it. Many children are prescribed an inhaled corticosteroid to be used daily regardless of symptoms. These steroids are colloquially referred to as "controller" medications as they help control symptoms. Conversely, albuterol is an asthma medication used when the child is experiencing signs and symptoms of asthma exacerbation. These medications are referred to as "rescue" medications as they are to be used to alleviate symptoms.

Residents were also responsible for consulting the CHW to identify and address social determinants of health and a pharmacist to provide meds-to-beds services as needed. This process is currently on hold as the CHW position has been eliminated.

A template for both an asthma-specific History and Physical and discharge document was developed to assist the physician team in ensuring all bundle elements were complied with.

At the start of each new block, physician leaders and the chief residents educate the oncoming residents about the project, their role in the project and review proper use of the MDI and spacer. A process map detailed all the necessary steps for residents to follow to ensure all bundle elements were provided before discharge.

Respiratory Interventions

RTs are responsible for providing one-on-one education for MDI and spacer technique. This team is also responsible for assuring patients requiring continuous albuterol nebulization in PICU are transitioned to an MDI and spacer immediately after weaning from the continuous medication rather than continuing to receive medications via nebulization. This provides the patient and family more opportunities to practice using the MDI and spacer to master the skill prior to discharge.

CHW Interventions

The CHW was responsible for meeting with all patients and families admitted for asthma in both PICU and General Pediatrics. She completed a social determinants of health screening and helped patients and families mitigate existing barriers to optimal health outcomes including follow-up appointments with a primary care provider and pulmonologist, secure safe housing, assist with transportation, and arrange assistance through community-based resources.

The CHW created a document for providers to know which asthma medications were covered by each insurance provider. This document was helpful to ensure patients were prescribed the correct medication and prevent delays when filling the medication at the pharmacy.

Pharmacy Interventions

Prior to discharge, patients and families who opt into meds-to-beds services have their prescriptions sent to the hospital pharmacy. A pharmacist designated to this project delivers the medications to the bedside to ensure there are no barriers to obtaining the medication after leaving the hospital. This touchpoint also serves as an additional educational session to review and reinforce how and when to use each medication, particularly distinguishing between "rescue" medications and "controller" medications.

Interdisciplinary Interventions

Bulletin boards hanging in prominent locations on both the IP ward and PICU serve as a gathering place for weekly QI huddles led by the APN. These boards show the latest information about bundle compliance and highlight the current PDSA cycle for each discipline.

We have held informal "pop-up" asthma educational booths in the main hallway of the hospital to provide asthma-based information and perform Metered Dose Inhaler and spacer demonstrations to both staff and visitors. We have also partnered with local community health

organizations to promote this project and reach a larger audience.

IV. Project Outcomes

Phase V- Project Evaluation Process

Outcomes Measurements and Plan for Data Collection

The APN leader randomly selected ten patients per month from a report generated by the EMR based on asthma-related ICD-10 codes. Patients less than two years old were excluded as were patients with a new asthma diagnosis. Each discipline-specific team received the list of patients and performed a retrospective chart review to audit their bundle elements. Bundle compliance was reported to the APN leader and discussed during monthly team meetings. A goal of 80% was set for each bundle element.

Qualitative

Given the turnover in staffing, reissuing the needs assessment to see if there were any changes in levels of confidence and skill among clinicians would be challenging. Thereby a needs assessment will be conducted quarterly to have a better understanding of long-term successes.

Quantitative

Providers increased the rates of AAP completion to 81% from 31% and patient and family education about the AAP increased to 84% from 63%.

Nurses increased their documentation of asthma-specific education including basic pathophysiology, symptoms of asthma exacerbation and triggers for asthma exacerbation using the templated education checklist to 70% from 22%.

Though we lost our CHW during the project phase, CHW consultation increased to 74% from 22%. These consultations ensured that patients and families were screened for SDH, were provided with community-based resources, transportation to-and-from appointments, when necessary, trigger abatement when appropriate (i.e., mold, extermination, etc.).

From project implementation in April of 2022 to present, there have been no asthma-related 72-hour admissions nor have there been any asthma-related 30-day readmissions. Length of stay (LOS) in the PICU decreased by 0.9 days, or 29%. Decreasing the LOS led to a cost reduction of approximately $3,000 per patient stay or a total savings of approximately $75,000. Despite the decreased LOS in PICU, the LOS increased in the IP ward by 0.6 days. The interdisciplinary team will continue to conduct PDSA cycles to look for factors contributing to that increase. Overall, total length of stay decreased by 0.3 days per asthma admission.

V. Summary, Conclusions and Next Steps

The results of this QI project provide a strong justification for the establishment of a standardized, comprehensive multi-disciplinary bundle to guide care for children with asthma. Additionally, the framework of this project is modifiable and can be made to accommodate the specific educational needs and promote self-care behaviors of children with chronic illnesses such as diabetes and sickle cell disease, two other chronic conditions with high morbidity and mortality in the pediatric population.

This project is ongoing, and we continue to work to achieve a goal of providing this bundle to at least 80% of the children and families admitted for asthma. Though the goal of 80% was not reached during the intervention period, the team was able to identify areas of improvement that will allow efforts to continue to improve asthma care.

There has been significant turnover in nursing in both the IP ward and PICU which makes sustainability challenging. Education on the asthma education and service bundle has been incorporated into orientation to assure that each new nurse learns the process and can provide return demonstration of MDI and spacer use to the Nursing Education team before teaching a patient or family.

A future goal of this project is to form a strong partnership with the Emergency Department, local pediatricians, pulmonologists, and school nurses to provide comprehensive and preventative healthcare for children with asthma to reduce hospital resource utilization, promote use of outpatient care providers, decrease asthma-related morbidity and mortality, and improve health outcomes.

Understanding the relationships between race and ethnicity and the physical and social environments of neighborhoods that contribute to the persistence of early childhood asthma is essential to guiding research, policies and interventions to reduce asthma. The Asthma and

Allergy Foundation of America states that structural and social determinants including racism, discrimination, education, physical environment, and access to healthcare play a significant role in asthma health outcomes. Inequities in respiratory health should be used to guide interventions and policies at local and national levels to improve health outcomes among those disproportionately affected by the environments in which they live (Zanobetti et al., 2022).

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VII Appendices

Appendix A

IRB Exemption Letter

SETON HALL UNIVERSITY
1 8 5 6

September 14, 2023

Emily Yates
Seton Hall University

Dear Emily,

The Proposal entitled "A Multidisciplinary Education and Service Bundle for Children Admitted for Asthma" has been reviewed by the Research Ethics Committee of the Seton Hall University Institutional Review Board and based on the information provided we found the same to be exempt from IRB approval. As per CFR **§46.104 Exempt research** (5) Research and demonstration projects which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine:
(i) Public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

Thank you for your cooperation.

Sincerely,

Mara C. Podvey, PhD, OTR
Associate Professor
Co-Chair, Institutional Review Board

Phyllis Hansell, EdD, RN, DNAP, FAAN
Professor
Co-Chair, Institutional Review Board

Office of the Institutional Review Board
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www.shu.edu

Appendix B

Needs Assessment

Unit _____ Role _____

1= not comfortable at all 5= very comfortable

1. How comfortable do you feel teaching patients and families about Asthma basics (i.e. pathophysiology)

   1-----2-----3-----4------5

2. How comfortable do you feel teaching patients and families about their triggers and how to control them?

   1-----2-----3-----4------5

3. How comfortable do you feel teaching patients and families about signs and symptoms of an asthma attack?

   1-----2-----3-----4------5

4. How comfortable do you feel teaching patients and families about signs and symptoms of an asthma-related emergency?

   1-----2-----3-----4------5

5. How comfortable do you feel teaching patients and families about managing asthma at home and school?

   1-----2-----3-----4------5

6. How comfortable do you feel teaching patients and families about using their asthma equipment (i.e. MDI and spacer)?

   1-----2-----3-----4------5

7. How comfortable do you feel teaching patients and families about their asthma medications (i.e rescue and controller)?

   1-----2-----3-----4------5

8. How comfortable do you feel teaching patients and families about their individual Asthma Action Plan?

   1-----2-----3-----4------5

9. Do you feel that you have the resources to effectively teach patients and families about asthma?

   YES NO

10. If you answered NO to number 9, please explain_____
    _____
    _____
    _____

January 2022

Figure 1

Logic Model

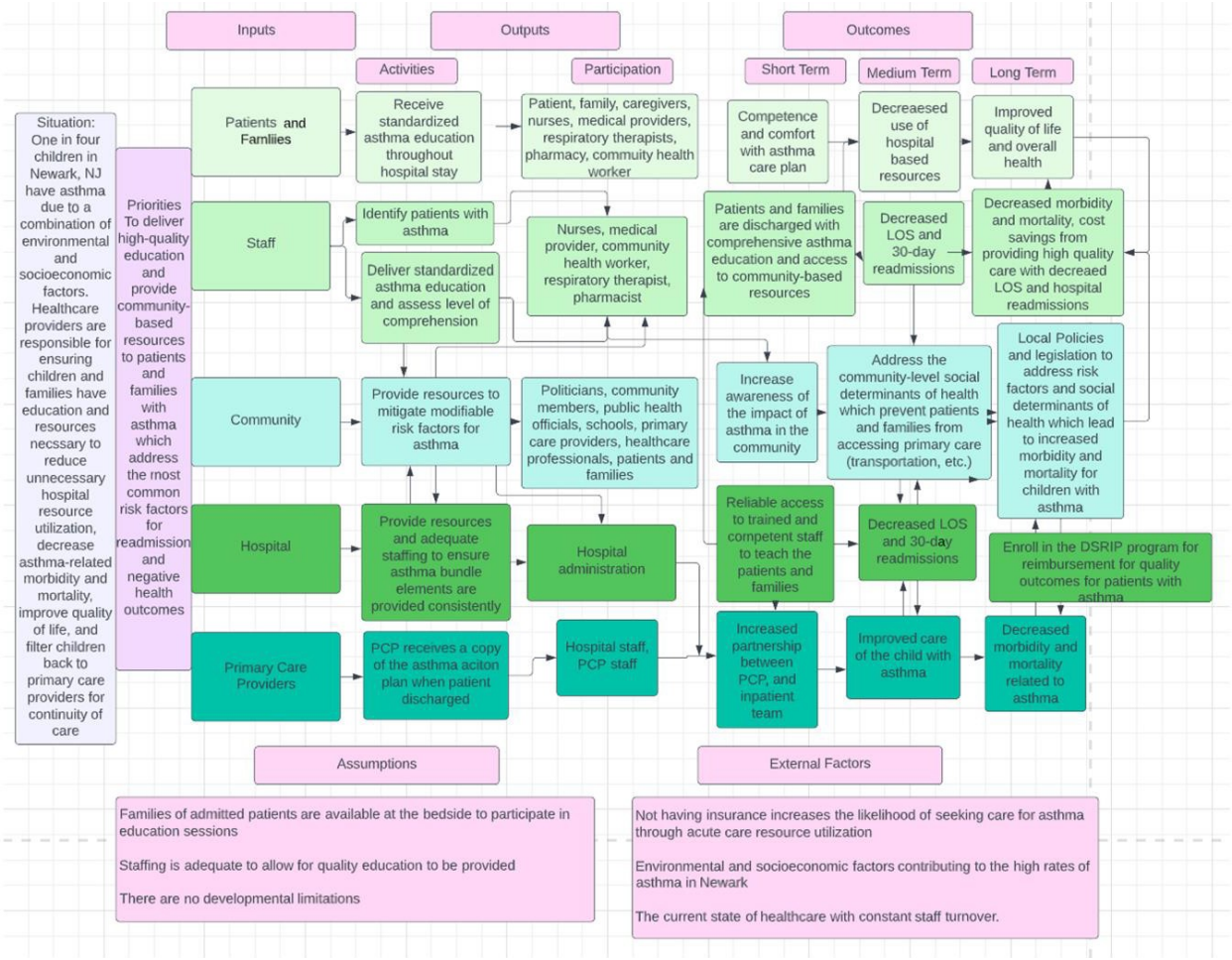

Figure 2

A-S-T-H-M-A Education Checklist

	Topic	Date	Teaching method* (see key)	Method of validation* (see key)	Comments	Signature of staff member
A	Asthma Basics					
S	Symptoms and Triggers					
T	Technique • MDI and spacer • Nebulizer					
H	Home care management • Social Work consult placed ☐					
M	Medications • Rescue medication • Controller meds • Monitor counter on MDI					
A	Asthma Action Plan					

Teaching methods:
D- Discussion
V- Video
HO- hand-out/pamphlet/booklet
Demo- Demonstration

Validation Methods:
VU- verbalized understanding
RD- return demonstration