An Integrated Regional Pediatric Asthma Program: Partnering with School Systems to Improve Child Health

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ABSTRACT

Asthma is a leading cause of chronic illness and school absenteeism in the United States and asthma-related health inequities persist. Innovative cross-sector interventions are needed to address inequities in pediatric asthma, yet few exist. This manuscript describes a regional pediatric asthma program that uses an integrated case management model of care. The program is innovative in that it provides cost effective outreach, integration across providers and systems, and access to care. We explore the unique history, successes, and experiences in addressing equity and a reduction of pediatric asthma hospitalizations and deaths in eastern North Carolina.

KEYWORDS: Health disparities, Health promotion, Bronchial Diseases, Asthma, Child Health, School Health, Absenteeism, Health Inequities, Health Services Accessibility, Southeastern United States, Academic Medical Centers, Health Services diseases, Accessibility, Rural Health Services, Community Health Services

Introduction

Asthma is a leading cause of chronic illness and school absenteeism in the United States.[1,2] Characterized by chronic inflammation of the airway that causes trouble breathing, pediatric asthma has both environmental and genetic risk factors. Pediatric asthma cannot be cured but can be managed with correct and consistent treatment.[3] In the U.S., racial, ethnic, and socioeconomic disparities in asthma outcomes persist.[4,5] Non-Hispanic Black youth have a higher death rate and are 4.5 times more likely to be hospitalized for asthma in comparison with non-Hispanic white children.[6,7] Additionally, studies have found a strong relationship between asthma disparities and Social Determinants of Health (SDOH).[8] Evidence includes links between asthma and social cohesion, housing conditions, neighborhood environment, green space, and food insecurity. Improvements in asthma outcomes will not be substantially made without also addressing underlying SDOH.

Eastern North Carolina is a rural region with high racial and ethnic disparities, health inequities and poor SDOH.[9] The region has poorer overall health as compared to the rest of the state, including in pediatric asthma. Between 2009-2016, counties with the highest asthma deaths were rural counties located in eastern North Carolina with high levels of poverty.[11] SDOH is important to address in this region because it is rural and has high poverty rates, both of which can exacerbate poor health outcomes. Emergency department visit rates for asthma among children 5-9 years old are higher in eastern North Carolina than in central and western North Carolina combined.[10]

Innovative, cross-sector interventions are needed to address pediatric asthma, yet few exist from challenges of implementing interventions that address multiple SDOH. This

manuscript introduces a novel program in Eastern North Carolina that incorporates SDOH into pediatric asthma care. We describe the unique history, successes, and experiences of the ECU Health Regional Pediatric Asthma Program with the Maynard Children's Hospital at ECU Health Medical Center. ECU Health Medical Center is a not-for-profit hospital system serving Eastern North Carolina and serves as the teaching hospital for the Brody School of Medicine at East Carolina University (ECU).

Program History

Since its inception in 1995, goals of the ECU Health Regional Pediatric Asthma Program are to improve quality of life and reduce emergency department visits, in-patient admissions, and school absenteeism for children with asthma in eastern North Carolina (ECU Health, 2023).[9,13] The history of the Regional Pediatric Asthma Program is outlined in Table 1. Currently, the Pediatric Asthma Program has a physician medical director and six full-time staff (one nurse manager, one social worker, and four respiratory therapists). The staff coordinate with 9 hospitals, 5 clinics, and 17 school systems across 17 counties in eastern North Carolina with plans to expand services to all 29 counties in the region.

Table 1. History of the ECU Health Regional Pediatric Asthma Program[9]

Year	Key Program Events
1995	• Development of Pitt County Asthma Coalition • Pilot of ECU Health Regional Pediatric Asthma Program (1 elementary school)
1996	• Duke Endowment funding to support Regional Pediatric Asthma Program • Community case management model with a nurse, respiratory therapist, and social worker
2020	• Pediatric Asthma Program becomes a Regional Pediatric Program • Funding from multiple non-profit organizations • Serves 7 counties in Eastern North Carolina
2024	• Continued growth to serve 17 counties in Eastern North Carolina

Community Partnerships

PAP's successful impact results from extensive community partnerships with public schools and primary care providers. The relationship between Program staff, school nurses, and primary care providers provides an integrated services approach to children in need. Referrals are available through electronic health records, fax, and email, and patients can contact an asthma care manager directly. Ultimately, children seen by PAP are better equipped to manage asthma conditions, allowing redistribution of school nursing resources. Partner roles are described in Table 2.

Table 2. Regional Pediatric Asthma Program Partners

Partner	Role
Program staff	• Include respiratory therapists, nurses, medical directors, social workers • Coordinate services with all other community partners • Facilitate collaboration between patient families and primary care providers
	• Provide outreach to schools with services, specifically those that have more pediatric asthma admissions to ECU Health system
Public Schools	• MOUs with public school systems in Eastern North Carolina • School nurses assist in treating students, communicate with parents, liaise with primary care providers, assist in access medications, ensure compliance
Primary Care Providers	• Monthly pulmonary clinics that offer specialty level care in collaboration with primary care providers • Clinics offered in 3 rural locations without these resources

Program Components

Key components of the ECU Health Regional Pediatric Asthma Program include asthma testing, education, supplies and environmental assessments and are described in Table 3.[13] Services are free and children up to 18 years of age are eligible to participate. A key difference between the PAP and the traditional health system approach is that it is not tied to an office setting and operates on grant funding, circumventing the often documentation and reimbursement requirements of insurance providers. The PAP has been able to expand services over a thirty-year period. However, reliance on grant funding can be an issue for sustainability and this should be taken into consideration for those seeking to replicate the PAP model.

Table 3. Regional Pediatric Asthma Program Components[13]

Component	Description
Testing	• Fractional Exhaled Nitric Oxide (FeNO) tests • Simple spirometry testing
Education	• Education tailored to communities served • Educational brochures and handouts • Example topics: ○ Causes of asthma exacerbations ○ Caring for a child with asthma ○ Step-by-step versions of how to use asthma medications
Supplies	• Spacers • Masks • Asthma Action Plan worksheet
Home Visits	• In home environmental assessments

Social Determinants of Health (SDOH)

When working in a rural region with high levels of poverty and limited access to specialty healthcare, addressing SDOH is a key component that makes the Regional Pediatric Asthma Program unique.[13] The program links patients and their families with community resources, even when those resources go beyond asthma treatment. The Pediatric Asthma Program connects patients with resources to find housing, medication assistance, reliable transportation, mental health support and more. Patients are also able to engage with the program through telehealth to overcome barriers related to childcare, work schedules and transportation. Addressing SDOH and addressing gaps to overcome disparities in healthcare options is the main driver of the program's reach throughout eastern North Carolina.

Pediatric Asthma Program Staff and Community Partner Reflections

Among the 6 fulltime staff members (nurse manager, social worker, 4 respiratory therapists) of the Regional Pediatric Asthma Program, several have worked within the program

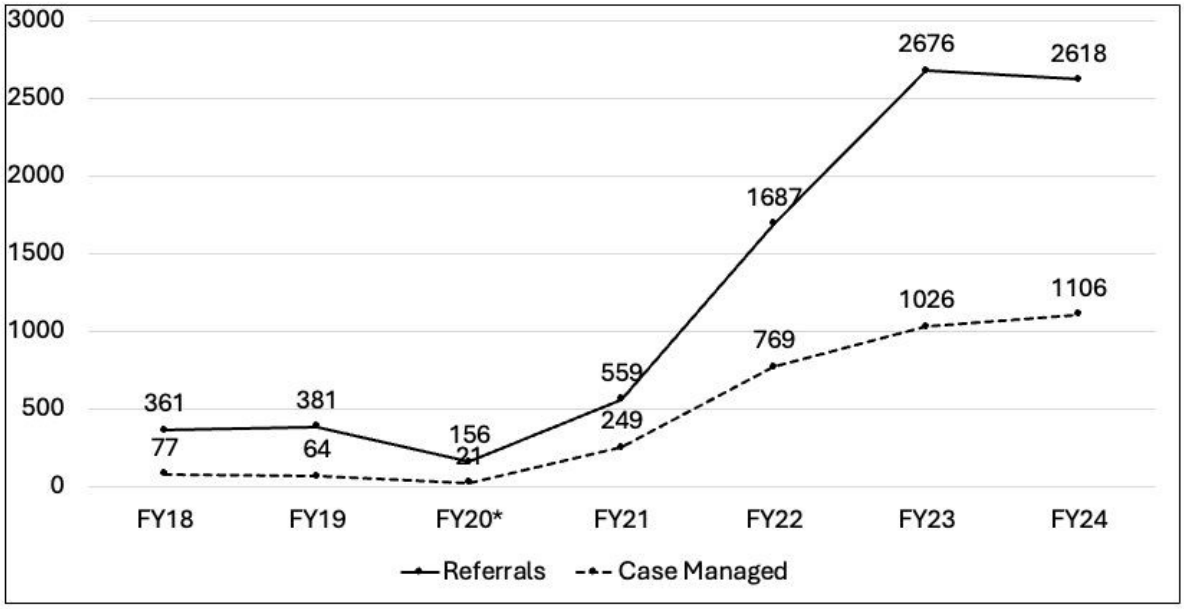
or at ECU Health for over 20 years. All full-time staff members contributed to the conceptualization and revision of this manuscript. Additionally, considering the wealth of experience these staff members have, they all provided feedback via phone or email about their experiences working with the program, including what the program means to them. Direct quotes from staff members are included below.

"I cared for many children with asthma, and I saw children die because of uncontrolled asthma. No child should ever die from asthma. With proper medication management and education, asthma is a manageable disease. Now that I am working on the community side, in more of a public health capacity, I see and better understand how vital our work is in the prevention of these deaths."

A common refrain from staff was how in previous hospital-based clinical work they saw children die from uncontrolled asthma. This program allows them to help the community in a broader way as compared to in-patient care. The experience of working at bedside and witnessing what asthma can do to a child drives their current motivation for stronger prevention and education. A large part of eastern North Carolina is rural with lack of access to healthcare and resources. PAP helps patients overcome challenges in their lives allowing enhanced quality of life, empowerment and freedom. The SDOH components are meaningful.

"The pediatric asthma program to me is about community. A great part of eastern North Carolina is very rural and there is a lack of access to health care and resources. The pediatric asthma program allows us to give quality care to people who otherwise would not have access to it; to our neighbors, family and friends, improving the quality of life and the health and wellbeing of the very communities we live in." – Respiratory Therapist

Figure 1: Expansion of Pediatric Asthma Program 2018-2024



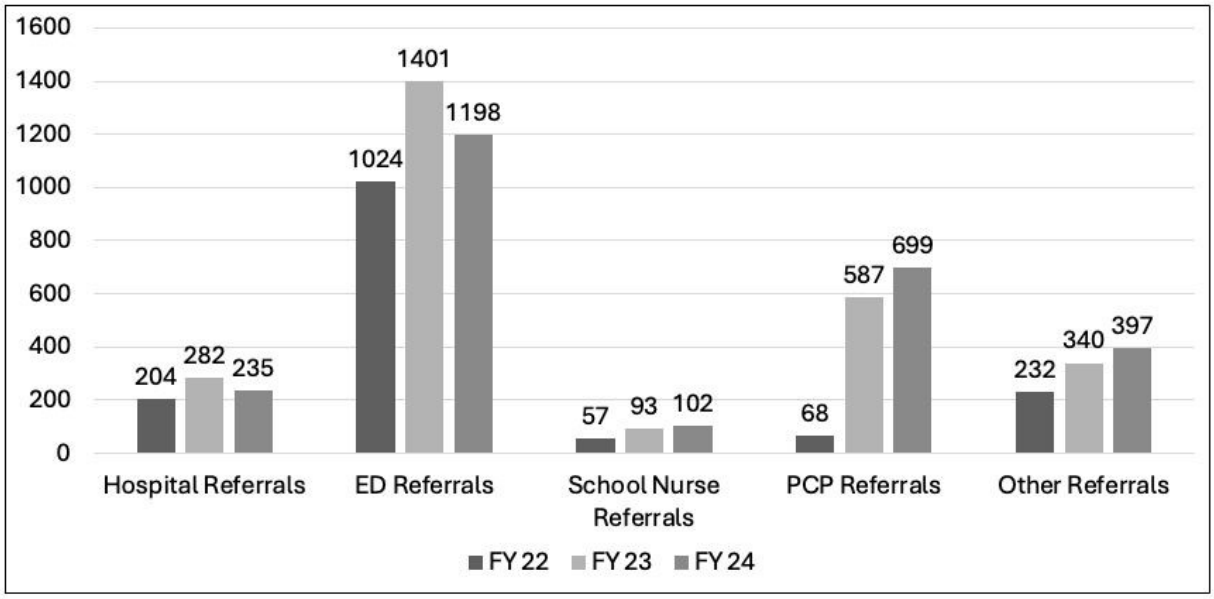
Program Results

Since PAP transitioned to a regional model in 2020, 3,171 children have been managed. Prior to 2020, there has been a 378.71% increase in referrals and 312.05% increase in the number of children enrolled (Figure 1). Based on average hospitalization costs the estimated cost savings from the ECU Health Regional Pediatric Asthma Program are $6.2 million saved based on case management of 1026 children. PAP program results are tracked internally by program leadership. Results shared here have not been published elsewhere and are not a part of a formal evaluation.

The year 2024 was pivotal with a collective 15.6% decrease in hospital referrals and 15.2% increase in school nurse, primary care physician and other community-based referrals (Figure 2). These findings indicate PAP's community-based efforts are preventing child hospitalization. Additional statistics from 2024 include 666 providers educated, 63 patients screened for SDOH, and 701 FeNO tests. Of FeNO tests completed, 43% showed inflammation that required intervention and 53% of patients having either a well-controlled classification status

or lack of an asthma diagnosis. Tools and supplies distributed included 3,460 spacers and face masks and 530 mattress and pillow covers.

Figure 2: Referral to Pediatric Asthma Program by source, 2022-2024



Source: Internal data collected and maintained by ECU Health Regional Pediatric Asthma team

Conclusions

The ECU Health Regional Pediatric Asthma Program has demonstrated nearly 3 decades of success and rapid growth in recent years. PAP is innovative in that it provides an integrated system of asthma management, prevention, resources, access to care and cost savings. A 2022 meta-analysis assessing asthma interventions that utilize Social Determinants of Health found that social-risk based interventions were associated with significantly reduced risk of asthma related emergency department visits and hospitalizations.[18] PAP plans to seek funding to conduct a rigorous program evaluation including all 29 counties in eastern North Carolina.

The work described can provide a pathway to replicate PAP best practices in other US regions. PAP recommends regions interested in developing similar programs should conduct a needs assessment to clearly understand community needs, barriers and ways to leverage existing partnerships and resources. This can provide a rationale to expand staff, services and seek funding. Building capacity can include strengthening partnerships with school systems, healthcare providers and others along with continued program expansion to coincide with number of patients served. The ECU Health Pediatric Asthma Program is a cost effective model that could be replicated to treat pediatric asthma in rural, low-income areas in other states and address health inequities in patient outcomes.

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