Implementation of a Respiratory Therapist–Driven Protocol for Spirometry and Asthma Education in a Pediatric Out-Patient Primary Care Setting

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BACKGROUND: Best practice guidelines for asthma management recommend education and spirometry at specific intervals. A written asthma action plan with education and spirometry is ordered at the discretion of physicians at our institution. An initial chart review revealed that asthma education and spirometry were not consistently ordered in the pediatric primary care clinics. This quality improvement study aimed to increase frequency of spirometry and asthma education in children with asthma seen in pediatric primary care through use of a respiratory therapist (RT)–driven protocol. METHODS: The protocol established that spirometry and education would be done annually for children ≥ 6 y of age with intermittent asthma and every 6 months for persistent asthma. RTs identified eligible subjects and placed the electronic medical record orders before the clinic visit. Physicians were invited to complete a questionnaire before and after protocol implementation to assess barriers and protocol satisfaction. RESULTS: Nine hundred and thirty-two children were included. Prior to protocol implementation, spirometry and education were completed in 64.9% and 62.6% of eligible children, respectively. Following protocol implementation, spirometry and education were significantly increased to 92.7% ($P < .001$) and 88.5% ($P < .001$), respectively. Physicians identified interruption in clinic flow as the primary barrier for ordering spirometry and were satisfied with the protocol. Physicians stated that communication with RT improved through use of this protocol. CONCLUSIONS: Implementation of an RT-driven protocol in an out-patient pediatric primary care setting significantly increased utilization of spirometry and education for children with asthma. RTs working in the pediatric out-patient primary care setting played a vital role in achieving best practices for asthma management. The implementation of the protocol enhanced interdisciplinary communication. *Key words: asthma; primary care; out-patient; children; spirometry; asthma action plan; respiratory therapist; protocol; quality improvement.* [Respir Care 2023;68(9):1195–1201. © 2023 Daedalus Enterprises]

Introduction

Asthma is the leading cause of chronic illness in children worldwide.[1] However, asthma is a manageable disease that can be controlled. Best practice for asthma management is driven by two major guidelines: the Global Initiative for Asthma, Global Strategy for Asthma Management and Prevention; and the National Heart, Lung, and Blood Institute Expert Panel Report 3.[2,3] Both guidelines recommend asthma education at every encounter and measuring spirometry at diagnosis or start of asthma treatment, 3–6 months after starting controller treatment then periodically.[2,3]

Use of an asthma protocol was previously found to improve adherence to evidence-based guidelines.[4] Asthma pathways and protocols for management of acute asthma have improved outcomes through decreased hospitalizations, decreased length of stay, and reduced duration of continuous albuterol.[5-13] Respiratory therapists (RTs) have a vital role in asthma management in a variety of care settings.[14] RT-driven protocols for acute asthma have been used successfully in the hospital and emergency department.[12,13,15,16] To our knowledge, there are no published studies of RT-driven protocols in the out-patient setting.

At our institution, designated RTs are exclusively assigned to provide asthma education in the out-patient clinic setting. Traditionally, RTs are included in pulmonary and allergy clinics; but at our institution, they also staff pediatric primary care clinics. Asthma education and spirometry are ordered at the discretion of the physicians. The asthma education order includes individualized patient/family education on guided

self-management, symptom recognition and response, demonstration and evaluation of aerosol device and medication delivery technique, trigger mitigation strategies, and a written asthma action plan. Basic spirometry testing is composed of a flow-volume loop.

Initial chart review revealed that asthma education and spirometry were not consistently ordered in the pediatric primary care clinics per best practice guidelines. The out-patient pediatric primary care clinics are staffed with an RT trained to obtain spirometry and provide asthma education. The aim of this quality improvement study was to increase the frequency of appropriate spirometry and asthma education for children with asthma, per national guidelines, seen in a pediatric primary care clinic through the use of an RT-driven protocol.

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QUICK LOOK

Current knowledge

Best practice guidelines for asthma management recommend asthma education and spirometry at specific intervals. Respiratory therapists (RTs) are assigned to our out-patient pediatric primary care clinics to provide asthma education and obtain spirometry. A chart review revealed that these measures were not consistently ordered for children who met criteria in the out-patient pediatric primary care setting.

What this paper contributes to our knowledge

Implementation of an RT-driven protocol in a pediatric out-patient primary care clinic was successful in increasing asthma education and spirometry for children with asthma per current guidelines. Although physicians were concerned about interruption in clinic flow, most were satisfied with the protocol. RTs in the out-patient setting can have a vital role in improving adherence to asthma guidelines.

Methods

The study was determined not human subject research by the institutional review board at the University of Arkansas for Medical Sciences. The quality improvement study was conducted at Arkansas Children's Hospital in one of the pediatric primary care clinics. Arkansas Children's Hospital is an urban, tertiary care children's hospital affiliated with the University of Arkansas for Medical Sciences and located in Little Rock, Arkansas. Arkansas Children's Hospital has 2 pediatric primary care clinics located on the main campus and 4 additional pediatric primary care clinics system wide.

Protocol criteria and workflow were developed by a multidisciplinary group of physicians and RTs and were based on national guidelines recommendations. The physicians included the medical director of the Asthma Program (RP) and the medical director of the Respiratory Care Services Department (AB). The RTs included the pulmonary laboratory supervisor (PL), out-patient clinical manager (SK), and RTs participating in the leadership of the Asthma Program (HL and KC). The RT-driven protocol established that spirometry and asthma education would be completed annually for intermittent asthma and every 6 months for persistent asthma. Children $\geq$ 6 y of age with a diagnosis of asthma documented in the electronic medical record scheduled for a pediatric primary care appointment with the reason of visit listed as health supervision exam, well-child check, or an asthma-specific visit type were eligible for the protocol. For children with intermittent asthma, spirometry and asthma education were ordered if it had been $\geq$ 12 months since the last spirometry or documented asthma education. For children with persistent asthma, orders for spirometry and asthma education were entered if it had been $\geq$ 6 months since the last spirometry or documented asthma education.

Children followed in pulmonary, allergy, or asthma clinic who had an encounter with the specialty provider within $\leq$ 6 months were excluded from the protocol. Children with a known developmental delay on their problem list were excluded from the spirometry order of the protocol as they are often unable to complete the test but were included for asthma education orders. However, physicians were able to order spirometry in children with developmental delay if

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Supplementary material related to this paper is available at http://www.rcjournal.com.

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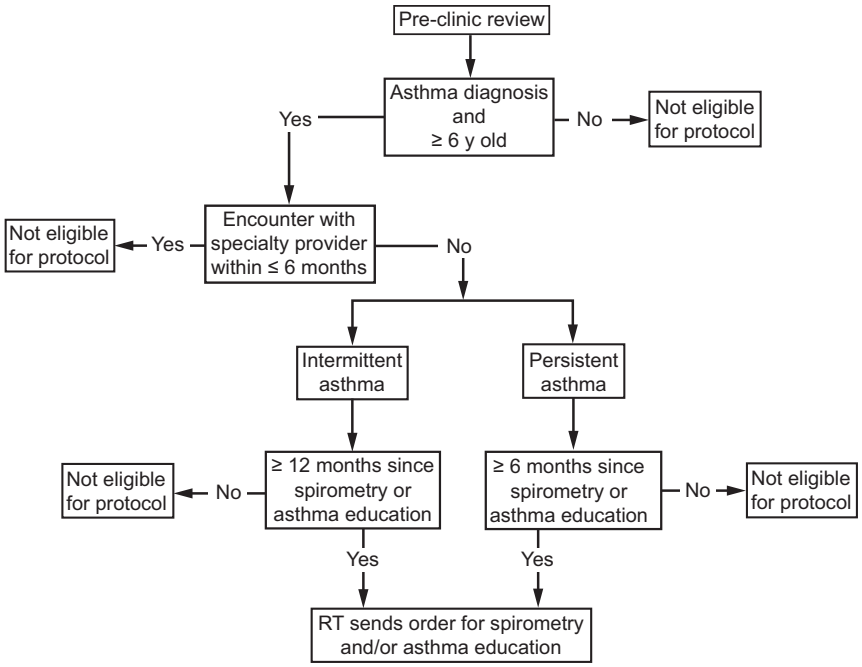

Fig. 1. Out-patient respiratory therapist–driven protocol. RT = respiratory therapist.

they thought they would be able to complete it. Figure 1 shows a flow chart of the protocol.

The RT assigned to the pediatric primary care clinic reviewed the upcoming patient schedule daily and identified children meeting protocol criteria. For those meeting criteria, the RT entered orders for spirometry and asthma education into the electronic medical record one business day prior to the scheduled appointment. Each morning, the RT reviewed the schedule with the physicians and discussed children who met criteria and would receive orders. The purpose of this huddle was to enhance communication between the RT and physicians. The RT assigned to the clinic provided asthma education and conducted spirometry.

The protocol was implemented in October 2021. A SMART (Specific, measurable, achievable, relevant, time-bound) goal was established to increase the frequency of ordered and completed spirometry and asthma education to ≥ 80% within 6 months. Pre-protocol data were collected for February 2019, May 2019, and January–May 2021. The authors wanted to include some pre-COVID data (2019) and randomly chose 2 months. Data from 2020 were excluded due to the COVID-19 pandemic causing extended closures to Arkansas Children's Hospital pulmonary labs including the pulmonary labs within the primary care clinics. Post-protocol data were collected from the date of implementation in October 2021–July 2022. Collected data included asthma severity, and demographics including age, sex, race, and ethnicity.

Physicians in the pediatric primary care clinic (pediatric residents and faculty) were invited to complete a survey (supplementary file, see related supplementary materials at http://www.rcjournal.com) prior to the development of the protocol and again 6 months after implementation. The survey was developed by 3 of the co-authors (KC, HL, and RP) and did not suffer any changes thorough the study. Questions focused on RT availability, barriers to ordering spirometry

Table 1. Subject Demographics

	Pre Protocol ($n = 495$)	Post Protocol ($n = 437$)	P
Age, y	10.8 ± 3.3	10.9 ± 3.4	.85
Sex			.38
Male	296 (60)	274 (63)	
Female	199 (40)	163 (37)	
Race			
Asian	2 (< 1)	3 (< 1)	.67
Black	378 (76)	325 (74)	.59
White	64 (13)	66 (15)	.17
Other	51 (10)	43 (10)	.83
Ethnicity			
Hispanic	41 (8)	39 (9)	.72
Non-Hispanic	451 (91)	392 (90)	.73
Unknown	3 (< 1)	6 (1)	.32
Asthma classification			
Intermittent	128 (26)	86 (20)	.02
Mild persistent	99 (20)	107 (24)	.11
Moderate persistent	246 (50)	222 (51)	.74
Severe persistent	13 (2)	9 (2)	.66
Unspecified	9 (2)	13 (3)	.28

Data are presented as mean ± SD or *n* (%).

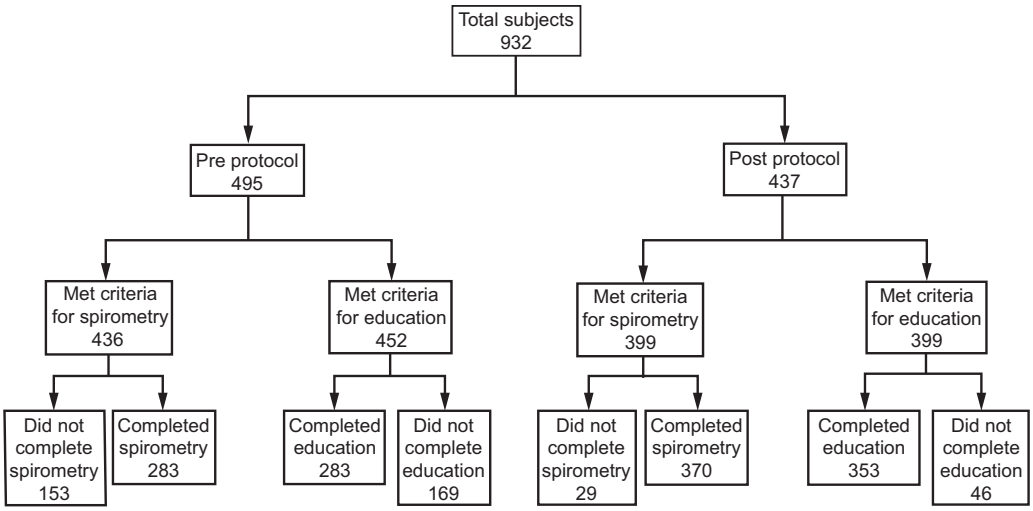

Fig. 2. Flow chart.

and asthma education, comfort with utilizing spirometry results, and importance of asthma education for self-management at home. The post-protocol survey included additional questions regarding physician satisfaction with the RT-driven protocol. Responses were collected and managed using REDCap electronic data capture tools hosted at Arkansas Children's Hospital.

Frequency and percentage were used to describe categorical data. Continuous data were expressed as mean ± SD. Unpaired *t* test with 2 tails and unequal variances was used to compare continuous variables. Fisher exact test with 2 tails was used to compare categorical data as well as pre-post survey data. A statistical software (Prism 9.5, GraphPad by Dotmatics, San Diego, California) was used for data analysis. $P < .05$ was considered statistically significant. P-charts were constructed using a statistical process control software (QI Macros 2017, KnowWare International, Denver, Colorado). P-charts, a control chart for proportions, were selected to allow month-to-month comparison of the outcome values that have different denominators.

Results

Nine hundred and thirty-two subjects were included in the study. There were 495 children in the pre-protocol group and 437 in the post-protocol group. Subject characteristics were similar between both groups except the pre-protocol group had slightly more children classified as having intermittent asthma ($P = .02$) (Table 1). The mean age for children in the pre-protocol group was 10.8 ± 3.3 y and 10.9 ± 3.4 y in the post-protocol group. The majority of subjects in both groups were male, Black, non-Hispanic, and were classified as having moderate persistent asthma.

In the pre-protocol group, 436 subjects met criteria for spirometry and 283 (64.9%) completed testing. Of 452 children eligible for asthma education, 283 (62.6%) received education from an RT. For children managed with the protocol, 399 met criteria for spirometry and 370 (92.7%) completed testing, whereas 399 subject were eligible for education and 353 (88.5%) were provided asthma education (Fig. 2). There were significant increases in both spirometry ($P < .001$) and asthma education ($P < .001$) in children eligible for these interventions following implementation of the RT-driven protocol (Fig. 3). Once the protocol was established, both completing spirometry and receiving asthma education remained above the set goal (≥ 80%) (Fig. 4).

The physician survey was sent to 115 licensed practitioners and was completed by 29 (25%) and 22 (19%) respondents before and after protocol implementation, respectively, (Table 2). Interruption to clinic flow was identified as the main barrier to ordering spirometry. The majority of physicians were comfortable utilizing spirometry data for clinical decision-making. All respondents indicated asthma education was important for self-management of asthma. Post-protocol implementation, the majority of physicians 20 (90.9%) were satisfied with the RT-driven protocol, and all respondents reported an RT was available when needed following protocol implementation. The open response comments received focused on improved communication between RT and licensed practitioner through use of the RT-driven protocol.

Discussion

An RT-driven protocol utilized in the out-patient pediatric primary care clinic setting was effective in increasing adherence to best practice guidelines for asthma. This RT-driven protocol significantly increased the percentage of children with asthma that had spirometry and asthma education at their general pediatrics clinic visit. The protocol

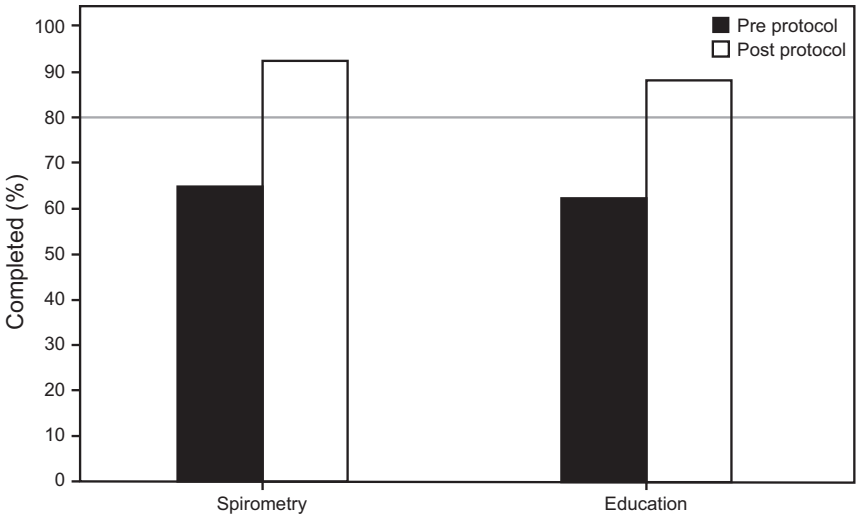

Fig. 3. Change in frequency of spirometry and asthma education completed before and after protocol implementation. Gray line shows goal (80% completion).

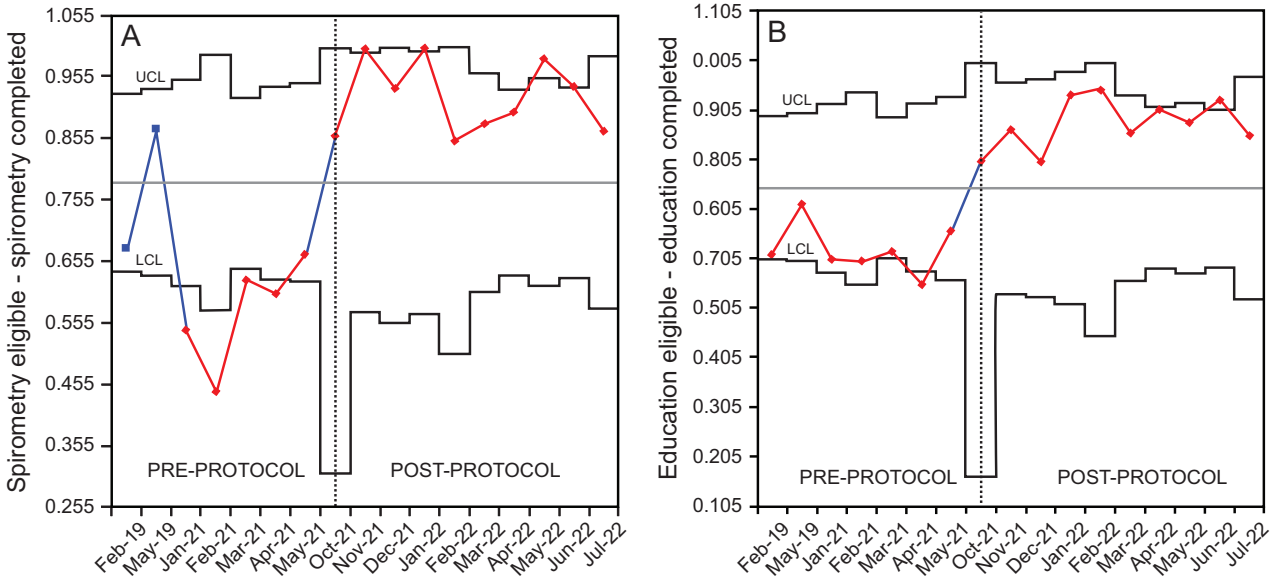

Fig. 4. P-chart for completion of spirometry (A) and asthma education (B) before and after protocol implementation. Upper control limit (UCL) and lower control limit (LCL) show ± 3 SD. Gray horizontal lines denote the control limit (mean of all values). Vertical dotted lines represent initiation of the protocol (October 2021). The change in color occurs each time the line crosses the control limit line.

was well accepted by licensed practitioners who thought that physician-RT communication improved since its inception. Physicians identified interruption to clinic flow as the main barrier to ordering spirometry.

RT-driven protocols have been successful in improving care.[4,13,16] Adherence to evidence-based guidelines for treating status asthmaticus improved with use of an asthma protocol.[4] Miller et al[4] demonstrated improved efficiency in rescue bronchodilator and systemic corticosteroid administration. Previously developed RT-driven protocols have successfully improved outcomes for patients with asthma in the acute care setting through reduced length of stay and decreased costs.[12,13,16] These protocols were all conducted in the in-patient and emergency department settings. Given the success of RT-driven asthma protocols for improving outcomes in the acute hospital setting, development of RT-driven protocols in ambulatory care should be considered.

RTs have played key roles in disease management for patients with chronic respiratory disease including asthma, COPD, and cystic fibrosis.[14,17,18] However, the majority of RTs work in an acute care setting. According to the American Association for Respiratory Care 2020 Human Resource

Table 2. Provider Questionnaire Results

	Pre Protocol ($n = 29$)	Post Protocol ($n = 22$)	*P*
RT available for spirometry in reasonable time frame			
Yes	26 (90)	22 (100)	.25
No	3 (10)	0 (0)	
Spirometry completed within workflow in useful way for clinical decision-making			
Yes	28 (97)	22 (100)	.99
No	1 (3)	0 (0)	
Barriers			
Excessive wait time for testing	9 (31)	9 (41)	.56
Results will not change clinical decision	5 (17)	3 (14)	.99
Interruption in clinic flow	17 (59)	11 (50)	.58
Excessive time spent on other items	13 (45)	6 (27)	.25
Family reluctance	10 (35)	9 (41)	.77
Not enough time since last spirometry	7 (27)	3 (36)	.37
Other	2 (7)	1 (4)	.99
No barriers	0 (0)	4 (18)	.02
Comfort with spirometry data utilization			
Very comfortable	12 (41)	11 (50)	.58
Somewhat comfortable	16 (55)	10 (46)	.58
Very uncomfortable	1 (3)	1 (4)	.99
Importance of asthma education for self-management			
Very important	29 (100)	22 (100)	.99
Satisfaction with RT-driven protocol			
Very satisfied	N/A	14 (64)	
Somewhat satisfied		5 (23)	
Neutral		3 (14)	
Satisfaction with RT communication			
Very satisfied	N/A	18 (82)	
Somewhat satisfied		2 (9)	
Neutral		2 (9)	
Supports ongoing use of RT-driven protocol			
Yes	N/A	22 (100)	

Data are presented as *n* (%).
RT = respiratory therapist
N/A = not applicable

Survey of RTs, approximately 4.8% of the 11,516 sampled RTs worked in an out-patient setting, whereas only 2.4% worked in a physician's office.[19] Despite the relatively small number of RTs in out-patient areas compared to the hospital, the role of the RT in out-patient settings continues to expand. Bellinghausen and colleagues[20] recently described inclusion of the RT in an ICU recovery clinic for patients receiving care for post intensive care syndrome. RTs are important members of the asthma management team and can offer significant support in asthma disease management within out-patient primary care clinics.[14]

Our study is the first report of an out-patient RT-driven protocol, highlighting the value of the RT in the general pediatrics out-patient setting. RT involvement in clinic preparation as well as adherence to the protocol was necessary for success of the protocol. Through RT participation, adherence to best practice guidelines for asthma management was increased in the out-patient pediatric primary care setting. Adherence to best practice guidelines for asthma management as recommended by current guidelines is likely to improve asthma care.[2,3]

Physicians who completed the questionnaire all reported asthma education was important for self-management. They also thought that the implementation of the protocol enhanced the communication between physicians and RTs. Interdisciplinary communication not only affects patient outcomes and satisfaction but also affects employee's engagement.[21] Thus, the implementation of the protocol had some beneficial and unplanned results. Physicians identified interruption to clinic flow as the main barrier to ordering spirometry. This could become a barrier for successful implementation of the protocol.

This study had some limitations to disclose. The duration of the study was limited to 6 months. However, due to the success of this protocol, it has been implemented in additional pediatric primary care clinics on campus, and the goal is to initiate this protocol system wide in the near future. We did not investigate the reasons testing and education were not ordered for children who met criteria, but we speculate that potential interruption to clinic flow is a common reason. This type of information is typically not documented in the medical record and would be difficult to attribute to specific causes or factors. Given the purpose of the study, we did not record either spirometry results, prescribed medication data, or changes in asthma outcomes as the result of the intervention. Future studies should evaluate patient-reported outcomes, use of rescue medications, and spirometric data. Finally, the response rate for the physician survey was low, which may result in non-response bias. We speculate that low response rate could be due to the fact that surveyed pediatricians cared for children with multiple diagnoses and asthma might have not been their primary focus. The replicability of this protocol would be challenging at institutions with limited resources. Due to the success of the implementation of this RT-driven protocol, we started implementation in another pediatric primary care clinic.

Conclusions

Implementation of an RT-driven protocol in a pediatric out-patient setting increased the utilization of spirometry and asthma education in children with asthma seen in a pediatric primary care clinic. The protocol helped meet best practice guidelines for asthma management, was well accepted by physicians, and enhanced interdisciplinary communication. These findings highlight the value of the RT and RT-driven protocols in the out-patient primary care setting.

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