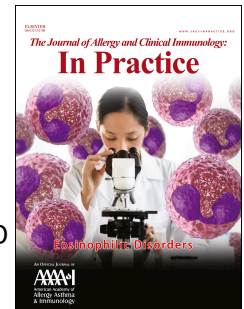


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The Asthma Toolkit Bootcamp to Improve Rural Primary Care for Pediatric Asthma

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The Asthma Toolkit Bootcamp to Improve
Rural Primary Care for Pediatric Asthma

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ABSTRACT

Background: Children with asthma living in rural areas receive most of their care from primary care providers (PCPs) who have variable knowledge of evidence-based guideline management.

Objective: To test the capacity of The Asthma Toolkit Bootcamp (ATB) program to improve PCP guidelines adherence and reduce healthcare utilization in rural children with asthma.

Methods: The ATB program provided intensive training in NHLBI guidelines-based asthma care, evaluated within a RE-AIM implementation science framework. All primary care practices serving pediatric patients in rural La Plata County, Colorado received 1) online instruction, 2) full-day training, and 3) follow-up, in-practice training one month later. Training focused on spirometry use, severity and control assessment, medication management, asthma action plan utilization, and adoption of a standardized visit protocol.

Results: RE-AIM evaluation determined successful enrollment of practices in La Plata County (Reach) and provider uptake of evidence-based practices including spirometry (Adoption). Pediatric asthma patients receiving spirometry increased from 22% pre- to 86% post-training; severity assessment from 47-88%; and action plans from 40-86%. Significant improvements in healthcare utilization were observed among trained practices including a 10% decrease in ED visits, 35% decrease in hospital admissions, and 29% decrease in oral corticosteroid prescriptions (Effectiveness). Comparison practices showed no significant reductions in healthcare utilization. Participating providers reported that having the training in their own community, intense practice, a team-based approach, and cost-free materials including the spirometer and patient education materials were particularly helpful.

Conclusion: The Asthma Toolkit Bootcamp improved pediatric asthma care given by rural providers and reduced healthcare utilization among their patients.

Highlight box**1. What is already known about this topic?**

Rural children with asthma often do not receive guidelines-consistent care. Current management guideline indicate that spirometry should be used by all providers, both primary care and specialist, for effective asthma management.

2. What does this article add to our knowledge?

The Asthma Toolkit Program brings intense, spirometry-focused training to rural primary care physicians to improve management and outcomes of pediatric asthma.

3. How does this study impact current management guidelines?

This study suggests that engaging rural providers in their community with interactive, repeated training focused on high-impact practice changes can improve asthma care and may improve asthma-related health outcomes.

Key words: asthma, primary care providers, guidelines

Abbreviations:

PCP – Primary Care Physician

ATB - Asthma Toolkit Bootcamp

SWCAHEC – Southwest Colorado Area Health Education Center

ACT – Asthma Control Test

C-ACT – Childhood Asthma Control Test

RCCO – Regional Care Collaborative Organization

ED – Emergency Department

CME - Continuing Medical Education

95 INTRODUCTION

96 While most discussions of asthma disparities focus on urban populations, low-income
97 children with asthma living in rural areas also experience gaps in their care(1,
98 2). Patients in rural areas often have limited access to specialist care, instead receiving
99 most care in primary care settings where evidence-based asthma care is inconsistently
100 delivered. Primary care practices may be reluctant to use spirometry and may have
101 inadequate training to do so accurately. Results from a U.S. survey of 1,412 primary
102 care providers (PCPs) indicated that only 16% used asthma action plans, 10.8% used
103 spirometry testing, and 16.8% used repeat inhaler technique assessment in their
104 asthma patients(3). Another PCP survey similarly documented care gaps, but revealed
105 that many providers knew about the importance of asthma education, asthma care
106 plans, and inhaler technique demonstration yet didn't employ them in practice(4).
107 Further, primary care utilization of spirometry, central to providing guidelines-directed
108 care, occurred in 20%(5) to 55%(6) of primary care patients with asthma, in contrast to
109 80% among asthma specialists(7).

110
111 Interventions designed to enhance diagnosis and management of respiratory diseases
112 by PCPs have met variable success and have not been implemented broadly(8).
113 Educational materials alone and passive lecture-format workshops are minimally
114 effective in promoting widespread implementation of evidence-based care(9). For
115 example, in a study aiming to improve guidelines adherence in 411 PCPs, those
116 providers randomized to two three-hour group sessions demonstrated no greater
117 guideline adoption than those randomized to one of two control groups (abridged
118 training or unrelated training)(10). Similarly, six hours of group spirometry training in 26
119 PCP practices did not increase frequency of spirometry use in asthma patients(11).

120
121 To improve asthma management for underserved children living in rural areas, we
122 developed an asthma training program to engage and train PCPs in their community
123 with emphasis on intense, hands-on spirometry practice as a central component to
124 delivery of guidelines-concordant asthma care. This report includes an assessment of
125 the implementation and effectiveness of the program in rural Southwest Colorado.

METHODS

The Asthma Toolkit Bootcamp (ATB) program aims to help rural PCPs deliver guidelines-based care to children with asthma. The program does not provide screening or care directly to patients for the reason that care delivery would end as the program is completed. Instead, by building community capacity, benefits to patients with asthma can sustain indefinitely. This study was reviewed and approved by the National Jewish Health institutional review board.

A practical approach. The ATB program was designed to embrace a practical approach to implementing asthma guidelines for children of all ages in busy primary care clinics with emphasis on spirometry skill and clearly-defined components of a standardized asthma visit. The research team did not interact directly with patients or attempt to evaluate provider diagnoses of asthma or its severity. Rather, the program was to directed to providers and designed to build capacity within each practice to provide asthma care. The program included the following: 1) an in-person provider and healthcare team engagement meeting prior to training; 2) a 90-minute online ATB course; 3) a live, interactive, multidisciplinary, one-day training workshop in the provider's community, followed by 4) an in-clinic follow-up visit one month later to bolster practice change; 5) webinar meetings as needed to reinforce learning; and 6) printed and web-based educational English and Spanish materials for use with patients by the healthcare team. Repeated spirometry practice was aimed at building sufficient skill at administration and interpretation. Further, because PCPs care for patients with many health concerns and face many time demands, creating efficiency was encouraged by helping each practice to establish a standardized approach to asthma visits. The complete training program awarded 8 hours of continuing medical education (CME) credit to providers. All training content followed NHLBI evidence-based asthma guidelines(12).

Stakeholder engagement. La Plata County (1700 square miles, population 53,000) in Southwest Colorado includes the town of Durango (population 17,000) and surrounding

rural territory. In this county, 6.9% speak Spanish at home but only 1.3% report difficulty with English; 4.5% of households are below the poverty line; 6.2% are Native Americans. In La Plata county, 90.9% of the population has health insurance with 31.2% of the county population having public insurance (13). Patients in La Plata County often drive many miles to see a primary care provider, and specialty asthma care is limited. Surrounded by mountains, travel to the nearest large city (Denver) for advanced care is an 8-hour drive, further complicated by winter weather and closed mountain passes. Exposure to agricultural particulates, heating with biomass fuels, and frequent high winds create additional burdens for patients with asthma. In recent years, forest fires in Southwest Colorado have added further hazards for children with asthma. In Colorado Health Disparities District 9, representing La Plata and surrounding counties in Southwest Colorado, 37.7% of the population is uninsured or on government insurance, double that of the Denver metropolitan area(14).

Nine months before training was initiated, ATB staff developed a working partnership with the Southwest Colorado Area Health Education Center (SWCAHEC) in Durango, Colorado. Area Health Education Centers receive funding from the Health Resources and Services Administration under the U.S. Department of Health and Human Services to bring health improvement initiatives to rural and underserved communities. ATB staff worked with the SWCAHEC advisory board to contact all practices providing pediatric care in La Plata County, Colorado to explain the program and invite participation. At the request of providers during the initial engagement, the online training was expanded to include video demonstrations of spirometry technique and the training workshop was scheduled on a Saturday.

The ATB guidelines-based training. Training began with a web-based module that provided an overview of guidelines-based asthma management, followed by ATB content that included a focus on 5 key components: (1) standardized assessment with the Asthma Control Test(15) or Childhood Asthma Control Test(16) (ACT/C-ACT), (2) spirometry, (3) severity/control assessment with controller/reliever management, (4) asthma action plan, and (5) in-clinic team approach for efficiency of implementation

during clinic visits (Table 1). Discussion of effective communication and promotion of adherence was also included in the online and in-person training.

Because spirometry is a key assessment tool in the asthma NAEPP guidelines(12), primary focus in the ATB program was placed on provision of and training in spirometry. In turn, spirometry results helped to provide guidance in appropriate treatment strategies and ongoing monitoring. In this approach, participating providers and staff members learned about spirometry and its interpretation in the initial online course. During the one-day workshop, every attendee administered and received spirometry. Each practice received an EasyOne® spirometer, chosen for its relatively easy adoption in primary care. Practice members were encouraged to discuss how responsibility for spirometry administration would be assigned in their practice, when during an asthma visit the spirometry would be administered, and how results from the spirometry and ACT/C-ACT would be made available when the PCP entered the exam room to see the patient. During the workshop, PCPs received additional training in interpretation of results, including a review of multiple case studies, while nurses and medical assistants continued practicing spirometry administration. Additional content in the online course and workshop included guidelines-directed treatment decisions, environmental interventions, effective provider-patient communication skills, and strategic patient education. Practices were given a supply of ATB patient education workbooks and instructional inhaler videos on electronic tablets. Paper and video content were delivered in both English and Spanish.

Follow up. One month following the workshop, an ATB trainer visited each of the practices to continue spirometry practice, discuss cases, and answer questions. The trainer guided practice staff to create a standardized asthma visit protocol, defining specific roles for specific staff including completing the ACT/C-ACT, administering spirometry, and communicating results to the PCP. For an additional 6 months, trainers were available to answer questions by phone or email, and providers could access the ATB website to obtain additional information and view spirometry demonstration videos.

Study design and outcome data. The study employed a pre- to post-intervention design with evaluation conducted under the RE-AIM implementation science framework(17-19). Additionally, healthcare outcomes were compared between trained practices and similar primary care practices in adjacent counties (comparison practices). Evaluation of the ATB included the first four RE-AIM elements: reach, adoption, effectiveness, and implementation.

Engagement (REACH). Rural PCP practices are typically very busy, endure constant interruption, have multiple demands, and experience difficulty keeping pace with new evidence-based guidelines. Available time to participate in continuing medical education programs, particularly those requiring hours of commitment, is limited. Therefore, the first phase of practice-based research was engagement and motivation of providers as evidenced by the number of providers and staff who fully participated in the program.

Guideline-consistent care (ADOPTION). Provider self-assessment through chart review is a well-established and reliable means of evaluating quality of care(20, 21), and carries the additional benefit of focusing providers on the care they are delivering. Each provider reviewed 5-10 of their own charts reflecting recent asthma visits. As an additional incentive, providers were encouraged to use the same chart review forms to meet their personal requirements for Medical Board Maintenance of Certification. Chart audits focused on four measurable elements of guidelines-based care: 1) use of spirometry, 2) severity assessment, 3) prescription of medication consistent with severity assessment, and 4) provision of an asthma action plan.

Healthcare utilization (EFFECTIVENESS). De-identified Pediatric Medicaid claims were obtained from Rocky Mountain Health Plans (RMHP), through RMHP's capacity as the Regional Care Collaborative Organization (RCCO) for Western Colorado and Larimer County (Region 1) within the Colorado Medicaid Accountable Care Collaborative. Claims were obtained for the trained practices in La Plata County and from 10 untrained comparison practices located in adjacent Colorado counties. While this database does not account for all patients seen in these practices, it provides comprehensive

information on low-income patients, the population of children at greatest risk for asthma disparities(22-24) and hence the target population for the ATB program. The patient populations of the 5 trained and 10 comparison practices were comparable and included 33-67% Medicaid members. Asthma claims data included pediatric emergency department (ED) visits, hospital admissions, oral corticosteroid intervention, and beta-2 agonist prescriptions.

Provider feedback (IMPLEMENTATION). The assessment of implementation concerns itself with understanding the factors that facilitate or prevent the uptake of guidelines care by providers. In this project, qualitative implementation data were gathered through surveys completed online by providers three months following the completion of training. Providers were specifically queried about barriers to guidelines adoption, elements of the ATB training that were particularly helpful or inadequate, and suggestions to improve the program.

Data analysis. Analyses of study outcomes under the elements of the RE-AIM framework included both quantitative and qualitative data. Assessment of *Reach* was accomplished by descriptive methods aimed at profiling the number of practices, providers, and staff included in all elements of the ATB training. Analysis of *Adoption* of guidelines-concordant practices reflected in reviews of charts before and after the training took place using Wilcoxon signed-rank tests. *Effectiveness* was assessed by comparing change in healthcare utilization from the year before to the year after the ATB program among Medicaid patients of trained and comparison practices in southwestern Colorado, using incidence rate proportion tests and chi-square tests of independence. To compare healthcare utilization among trained and comparison practices, the number of observed health events per 5,000 person years pre- and post-ATB was tabulated in a contingency table for each health event. Chi-square tests of independence were conducted using these tables. Five thousand person-years was selected because that is the thousand person-year increment for which complete data was available for both trained and comparison practices (see total available person-years data under *Effectiveness*). *Implementation* was assessed through qualitative

281 analysis of provider feedback. All analyses were conducted using *R* statistical
282 software(25-27). A p-value of ≤ 0.05 was considered statistically significant for all tests.

283

RESULTS

Results are presented under four components of the RE-AIM framework(17-19).

Reach. ATB faculty met with two pediatric and three family medicine practices, representing all primary care practices for children in La Plata County. Providers did not practice in adjacent counties, hence minimizing potential contamination between trained and comparison practices. A total of 18 physicians, 6 nurses and 6 medical assistants completed all three components of the training including the online course, one-day workshop, and in-practice visit. At the request of the practices, the one-day workshop was held on a Saturday; consequently, all providers from the 5 practices participated. Adoption. The objective of the ATB program was to increase adoption of NHLBI evidence-based guideline for care of children with asthma. The 5 La Plata practices varied in their interest and motivation to adopt the guidelines-based practice changes. The most effective guidelines adoption occurred where a single “asthma champion” took responsibility for bringing change into the practice and where medical assistants were allowed to take a lead in standardizing responsibilities and creating a patient flow template. Self-reported chart audits and surveys were completed by all prescribing providers who participated in the program. Figure 1 examines the change in the percent of asthma visits containing each of the four elements of evidence-based asthma care in the year prior versus following the training, as reported by the providers. Inclusion of these elements in asthma visits increased significantly for all elements of asthma visits.

Effectiveness. Effectiveness of the program was assessed through examination of health outcomes data from the RCCO Medicaid database. These data were obtained for both the 5 trained La Plata County practices and the 10 untrained comparison practices in adjacent counties, reflecting all primary care providers in these counties.

Demographic characteristics of the populations of La Plata vs. adjacent counties are comparable for percent of households that speak Spanish (2.4 and 2.3 respectively), are under the poverty line (4.5 and 7.4), have unemployed members (4.1 and 3.7), and have health insurance (90.9 and 90.2)(13). Pediatric ED visits, hospital admissions, oral corticosteroid prescriptions, and beta-2 agonist prescriptions were documented for a two-year period spanning one year pre-training through one year post-training. Data

compiled by RCCO takes the form of counts of events and person-time available for that patient. The data encompassed records of a total of 35,599 children: 7,472 in the region where providers were trained, and 28,127 in the comparison region. Total person-time available per group was 5,347 years for the trained group, and 16,641 years for the comparison group. Incidence rates of ED visits, hospital admissions, oral corticosteroid prescriptions, and beta agonist prescriptions were calculated using total observed number of events and total observed person-time in the data set(28). Incidence rate proportion tests comparing within-group change pre- to post-training revealed statistically significant reductions in rates of ED visits, hospital admissions, and oral corticosteroid prescriptions in the 5 trained practices (see Figure 2). For the 10 comparison practices, incidence rate proportion tests revealed either no significant differences (ED visits and hospitalizations) or significant *increases* (oral corticosteroid and beta-agonist prescriptions) in asthma care utilization rates. Between-group comparison of change in healthcare utilization was conducted using chi-square tests of independence on observed utilization rates pre- and post-training per 5,000 person-years. The differences in observed events between groups was statistically significant for hospital admissions, oral corticosteroid prescriptions, and beta agonist prescriptions (respectively, χ^2 : 5.03, p = 0.025; χ^2 : 15.48, p < 0.001; χ^2 : 6.43, p = 0.011). For ED visits, the difference in observed events approached significance (χ^2 : 3.13, p = 0.077). Raw counts of observed health events and chi square test results are presented in Table E1 in the online repository.

Implementation: Providers were queried about their perceptions of barriers and facilitators of practice change, and suggestions about how to make the ATB program more effective (Table 2). Comments received from more than one trainee are listed once in order of frequency. Barriers to guideline uptake were largely internal and included inadequate time during visits, inadequate support staffing, and provider resistance to workflow change. Participants found repeated spirometry practice and emphasis on teamwork and practice flow helpful. At the same time, others indicated a desire for more assistance with both administration and interpretation of spirometry. Additional suggestions included the desire for improved online training and additional

ongoing training support. Family medicine providers, who also treat adults, in some instances asked questions during the training about the treatment of adult asthma and the differentiation between asthma and COPD. Some of these providers suggested that inclusion of these topics in the ATB would be helpful.

DISCUSSION

The Asthma Toolkit Bootcamp (ATB) demonstrated successful Reach, Adoption, Effectiveness, and Implementation. All primary care practices in rural La Plata County chose to participate. We have previously reported that the ATB increased adoption of guideline-concordant care(29). This study went further to provide Medicaid outcome data demonstrating that provider increases in delivery of guidelines-consistent asthma care was followed by a reduction in urgent care utilization. Participating providers reported that they found particular value in the community-based training, cost-free materials including the spirometer and patient education materials, intense practice, and the team-based approach.

Previous studies have revealed that guidelines-based asthma care can improve asthma outcomes for most children with asthma when implemented in urban metropolitan clinical research trials(30-32). In other cases, training programs have been only partially effective and did not result in meaningful changes in practice behavior(10, 11). For example, an intervention to increase guidelines-concordant care recruited one clinician from each of six practices to receive training and then systematically introduce changes into the larger practice; most practices demonstrated increases in severity assessment and use of asthma action plans, but not in adoption of spirometry(33). Recognizing that programs moving toward greater provider engagement tend to be most effective in changing care practices, the ATB was designed to provide repeated, interactive, in-community and in-practice training. Tailored approaches that engage providers and include multiple opportunities for interaction and feedback are markedly more likely to change practice behavior(21). A survey of 784 PCPs concluded that continuing medical education (CME) programs addressing respiratory disease management had not adequately reached primary care practices, and that clinicians were less interested in attending distant sessions with opinion leaders, preferring live presentations,

information they could access from their office, and content relevant to their daily practice(34). Relatively few asthma provider training studies have included assessment of healthcare outcomes. In one successful study, pediatricians from 10 urban centers received 2-session, interactive training in asthma care without spirometry. Patients of these clinicians demonstrated fewer symptom days and asthma-related emergency department visits than those from control pediatricians(35).

This study has limitations. PCPs may see children with asthma infrequently and hence may have difficulty maintaining staff skills in its administration. Medicaid data were observational, retrospective, and represent only about half of the patients in each practice. While the ATB goal of accurate assessment of asthma severity/control can improve appropriate controller medication prescribing and patient adherence(36), the observed differences between groups only *suggests* that the training was a key element of change. PCPs conducted their own chart reviews, an established and valid approach to outcome evaluation but nonetheless one with potential bias. The study did not attempt to evaluate the accuracy of severity assessments by participating PCPs, only whether a severity assessment was recorded. There may be other latent factors that characterize the differences between the groups. Although inclusive of all clinics in rural La Plata County, the total number of participating providers and staff was only 30, and assessment of *Implementation* was limited to provider chart reviews. Notably, providers indicated a desire for even more follow up support than included in this program. Continued development of innovative training approaches, including use of online and telemedicine training and electronic medical record pathways, may have potential to decrease training cost and improve healthcare outcomes.

Rural, primary care-focused research in asthma health disparities has received little attention relative to urban children with asthma. Nonetheless the approximately 4 million asthma patients living in rural areas stand to benefit when provider asthma care skill increases. Evidence from this study indicates that engaging rural providers in their community with interactive, repeated training focused on high-impact practice changes can improve asthma care and, consequently, healthcare outcomes.

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531 LEGENDS

532 Figure 1: Comparison of Provider-Reported Inclusion of Guidelines-Based Elements of

533 Asthma Visits from One Year Pre-ATB to One Year Post-ATB

534 Figure 2. Changes in Asthma Healthcare Utilization from One Year Pre-ATB to One

535 Year Post-ATB

536

Table 1. Asthma Toolkit Bootcamp training content

	Standardized Assessment	• Asthma Control Test (ACT), ages 12 years and older • Childhood Asthma Control Test, ages 4-11 years
	High Quality Spirometry	• Consistent coaching technique • Emphasize repeatable, accurate results
	Control Assessment	• Symptom frequency • Impairment • Risk of exacerbation • Lung function
	Asthma Action Plan	• Emphasize review with patients • Facilitate EMR Implementation of AAP
	Clinic-specific Asthma Care Workflow	• Plan asthma patient experience from first interaction at reception • Designate staff member(s) who will obtain spirometry, ACT before provider enters the exam room

TABLE 2. Provider survey results

BARRIERS	FACILITATORS	CHANGES NEEDED
• Not enough time • Not enough support staff • Provider and staff resistance to work flow changes • No standardization of visits • Patient nonadherence • Getting ACT and action plan into the EMR	• Local training • Easy-to-use spirometer and training • Education materials • Training as a team • Lots of practice • Assigning of responsibilities	• More spirometry administration and interpretation training • More training about the distinction between asthma and COPD • Better training videos • Ongoing support

Table E1. Observed Counts of Health Events by Practice Group per 5000 Person-Years Among Pediatric Patients with Asthma

	HOSPITAL ADMISSIONS	
	Trained Practices	Comparison Practices
PRE-TRAINING	146	94
POST-TRAINING	94	95
	$\chi^2 = 5.03, p = 0.025$	
	EMERGENCY DEPARTMENT VISITS	
	Trained Practices	Comparison Practices
PRE-TRAINING	2679	2028
POST-TRAINING	2416	1971
	$\chi^2 = 3.13, p = 0.077$	
	ORAL CORTICOSTEROID PRESCRIPTIONS	
	Trained Practices	Comparison Practices
PRE-TRAINING	236	262
POST-TRAINING	168	313
	$\chi^2 = 15.48, p < .001$	
	BETA AGONIST PRESCRIPTIONS	
	Trained Practices	Comparison Practices
PRE-TRAINING	665	499
POST-TRAINING	600	557

	$\chi^2 = 6.43, p = 0.011$
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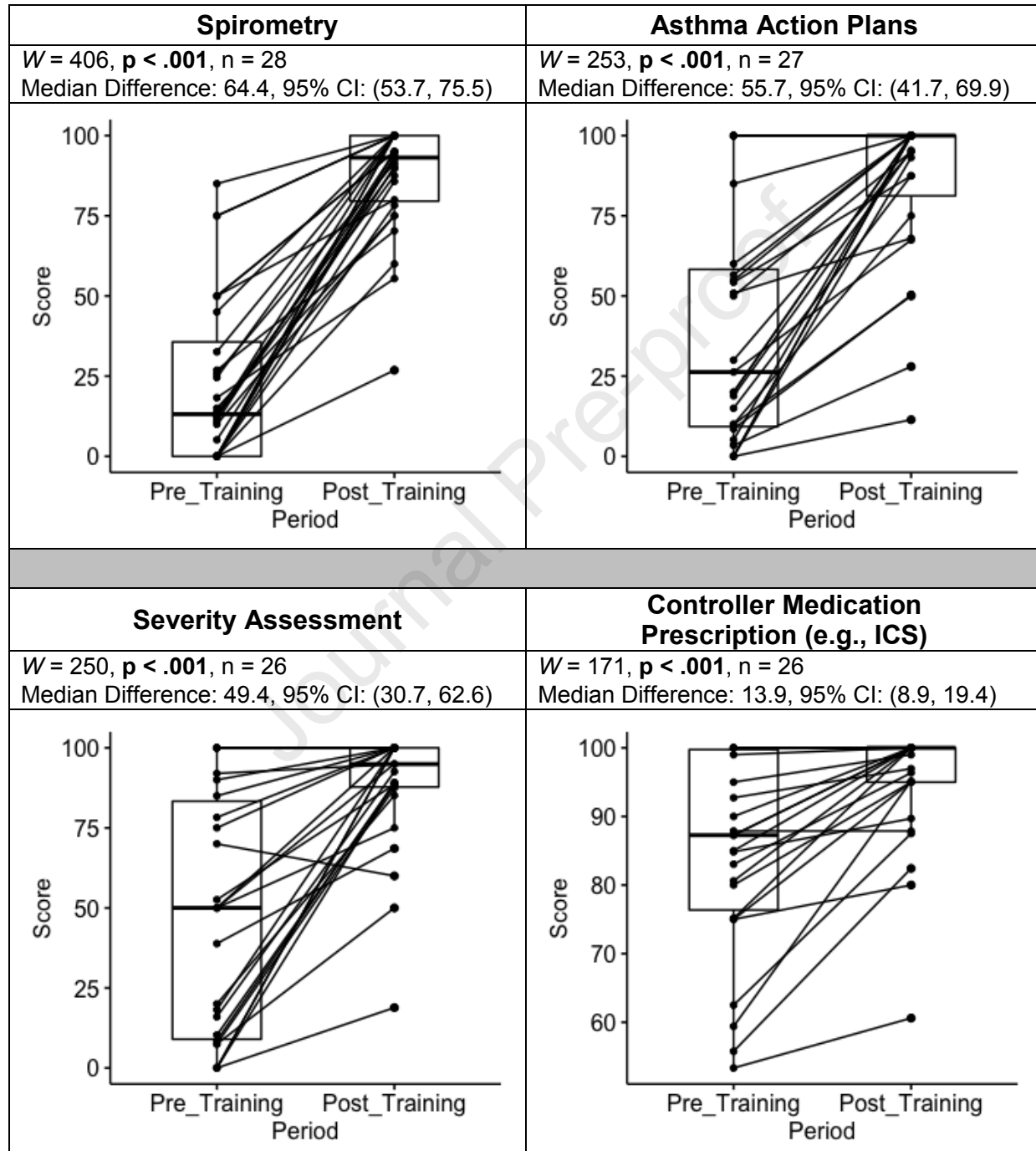
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Journal Pre-proof

Figure 1. Comparison of Provider-Reported Inclusion of Guidelines-Based Elements of Asthma Visits from One Year Pre-ATB to One Year Post-ATB using Wilcoxon signed-rank tests



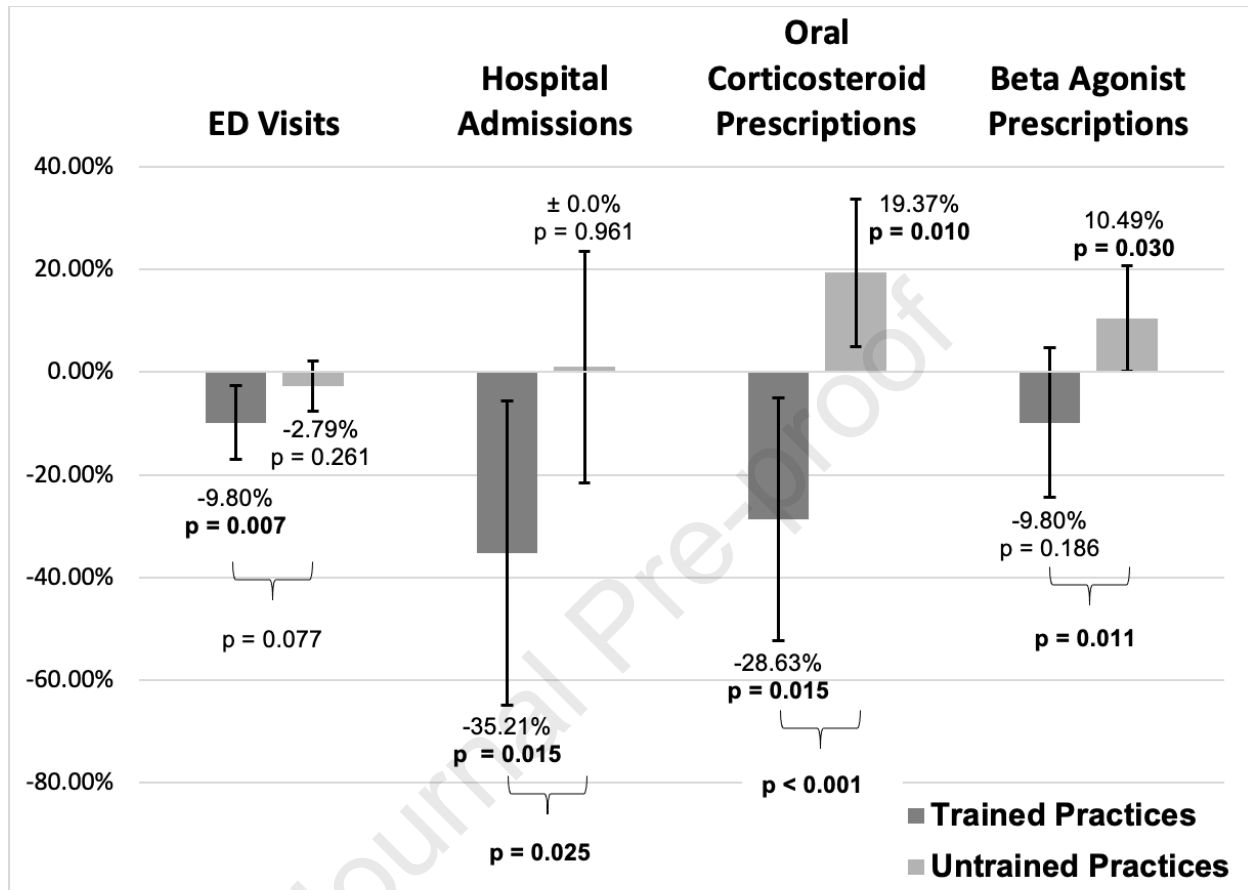
Legend

ICS: Inhaled Corticosteroid

W: Wilcoxon signed-rank test statistic

n: Sample size of test

Figure 2. Changes in Asthma Healthcare Utilization from One Year Pre-ATB to One Year Post-ATB



Bars represent 95% confidence interval for within-group pre-post incidence rate proportion test.

Brackets represent between-group comparison via chi-square test of independence on observed events per 5000 person-years.