

Clinical Communications

Validity of asthma disease direction, bother, and risk as self-reported asthma morbidity measures in urban teens

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Clinical Implications

- The Asthma Control and Communication Instrument can be used by various health care providers to easily and more comprehensively measure multiple important dimensions of asthma morbidity in adolescent populations.

TO THE EDITOR:

Most asthma questionnaires focus exclusively on symptom control. However, guidelines from the National Institutes of Health recommend evaluating multiple dimensions of asthma health, including symptom control, quality of life, exacerbations, pharmacotherapy, lung function, and communication.¹

Disease trajectory ("Direction"), burden ("Bother"), and asthma exacerbations ("Risk") are validated dimensions of asthma health² of the pediatric Asthma Control and Communication Instrument (ACCI) (parent-completed) and the adult ACCI (self-completed). ACCI Control is a valid self-reported measure of asthma control for adolescents.³ We evaluated the validity of the self-reported Direction, Bother, and Risk components of the ACCI among adolescents.

We included data from children in the Rochester City School District (ages 12-16 years) with doctor-diagnosed and persistent asthma, identified through school-based screening and enrolled in the School-Based Asthma Care for Teens study. We excluded those unable to speak and understand English, with a complex medical history, or no telephone. Data collection occurred between November 2014 and March 2017. The University of Rochester Institutional Review Board approved the study.

The current analysis focuses on 3 of the 5 ACCI domains (see Figure E1 in this article's Online Repository at www.jaci-inpractice.org), assessed over the past month:

1. **Direction**—change in asthma status (better, same, worse);
2. **Bother**—disease burden (not bothered, somewhat bothered, very bothered);
3. **Risk**—emergency department (ED) visits, hospitalizations, and oral steroid use.

Nine measures of asthma morbidity were also assessed:

1. *ACCI Control*, which assesses the frequency of daytime symptoms, short-acting beta₂-agonist use, attacks, activity limitation, and nocturnal symptoms over the previous 1 to 2 weeks. Control scores range from 0 (best control) to 19 (worst control);
2. The *Pediatric Asthma Quality of Life Questionnaire*⁴;

3. *Symptom-free days*⁵ over the previous 2 weeks;
4. *Missed school days* over the previous 2 weeks and previous year;
5. *Asthma Symptoms* (daytime symptoms, nighttime symptoms, rescue medication use, and activity limitation over the previous 4 weeks), using the National Institutes of Health Expert Panel Report 3 guidelines¹;
6. *Health Care Use for Asthma*: the frequency over the previous 12 months of asthma-related doctor visits, ED visits, hospitalizations, and urgent care visits;
7. Albuterol use over the previous week (1-2 days, 3-6 days, daily);
8. *Spirometry*: FEV₁ as a percentage of predictive values (FEV₁%); and the ratio of FEV₁ to forced vital capacity;
9. Fractional *exhaled nitric oxide*.

We examined mean asthma morbidity values across the Direction, Bother, and Risk domains of the ACCI using ANOVA. Because there were few reported hospitalizations and ED visits, a post hoc Any Risk variable was constructed that combines all 3 ACCI Risk indicators. Analyses were performed using STATA 11 (Stata Corp, College Station, Texas). All analyses were 2-sided, and a *P* value of less than .05 was considered statistically significant.

Most of the 280 participants were male (56%), black or Hispanic (84%), and on public insurance (84%), had uncontrolled asthma, and had a mean age of 13 years (Table 1). Ten percent reported an ED visit, hospitalization, or oral steroid use in the previous month.

TABLE 1. Sociodemographic and asthma characteristics of participants

Characteristic (N = 280)	n (%) of participants	Mean ± SD (min, max)
Age (y)		13.4 ± 1.1 (12, 16)
Sex: male	156 (56)	
Medicaid	234 (84)	
Race/ethnicity		
Black	141 (51)	
Hispanic	90 (33)	
Other	22 (7)	
White	15 (5)	
Black/white	11 (4)	
ACCI Risk events in the previous month: ED visits, hospitalizations, and/or oral steroid use		
No events in previous month	252 (90)	
1 event in previous month	16 (6)	
2 or more events in previous month	12 (4)	
ACCI Control score*		3.7 ± 3.2 (0, 14)
Persistent asthma identified by ACCI	187 (67)	

PCP, Primary care provider.

All columns of data do not add up to 100% because of rounding.

*Score >3 indicates uncontrolled asthma.

TABLE II. Discriminant properties of ACCI Direction, Bother, and Risk: Mean values (95% CI) of asthma control (ACCI score), quality of life (PAQLQ), missed school days, and asthma-related health care use values across Direction, Bother, and Risk categories using ANOVA

Indicators of asthma status	Description							
	Getting better (n = 130)	Staying the same (n = 122)	Getting worse (n = 28)	Not bothered (n = 102)	Somewhat bothered (n = 156)	Very bothered (n = 22)	No risk (n = 252)	Any risk (n = 28)
ACCI score*	3.2 (2.7-3.7)	3.2 (2.8-3.7)	7.6† (6.3-9.0)	1.4 (1.1-1.8)	4.4 (4.0-4.9)	8.6‡ (7.3-9.9)	3.4 (3.0-3.7)	6.4‡ (4.9-7.9)
PAQLQ	5.7 (5.5-5.9)	5.6 (5.4-5.8)	4.3† (3.8-4.9)	6.4 (6.3-6.5)	5.3 (5.1-5.4)	3.6‡ (2.9-4.3)	5.6 (5.5-5.8)	4.8‡ (4.2-5.4)
Symptom-free days	9.6 (9.1-10.1)	8.9 (8.3-9.4)	4.3† (3.6-5.1)	11.1 (10.5-11.8)	8.0 (7.5-8.4)	3.1‡ (2.4-3.9)	9.1 (8.7-9.5)	5.6 (4.8-6.6)
School days missed for asthma in past 2 wk	0.3 (0.2-0.4)	0.2 (0.1-0.2)	1.4† (1.0-1.9)	0.1 (0.0-0.2)	0.3 (0.2-0.4)	1.3‡ (0.9-1.9)	0.2 (0.2-0.3)	1.3‡ (0.9-1.7)
School days missed for asthma in past year	3.8 (3.5-4.2)	3.5 (3.2-3.8)	5.6 (4.8-6.6)	3.0 (2.6-3.3)	3.7 (3.4-4.0)	8.8‡ (7.6-10.2)	3.5 (3.3-3.8)	6.8‡ (5.9-7.8)
Health care use for asthma								
PCP visit (n = 142)	1.5 (1.3-1.7)	1.6 (1.3-1.8)	3.6‡ (3.0-4.4)	1.0 (0.8-1.2)	1.8 (1.6-2.0)	5.0‡ (4.1-6.0)	1.4 (1.2-1.5)	5.1‡ (4.3-6.0)
ED visit (n = 62)	0.3 (0.2-0.5)	0.4 (0.3-0.5)	1.3† (0.9-1.8)	0.2 (0.1-0.3)	0.5 (0.4-0.6)	1.6‡ (1.1-2.3)	0.3 (0.2-0.4)	1.8‡ (1.4-2.4)
Hospitalized (n = 16)	0.0 (0.0-0.1)	0.1 (0.0-0.1)	0.6† (0.3-0.9)	0.1 (0.0-0.2)	0.1 (0.0-0.2)	0.3 (0.1-0.6)	0.1 (0.1-0.1)	0.2 (0.1-0.4)
Urgent care (n = 32)	0.2 (0.1-0.3)	0.1 (0.1-0.2)	1.2 (0.8- 1.7)	0.1 (0.0-0.1)	0.1 (0.1-0.2)	0.2 (0.1-0.6)	0.1 (0.1-0.2)	0.3‡ (0.1-0.5)
ACCI rescue medication use								
0, 1-2 d in past week	85%	86%	61%‡	97%	79%	45%‡	87%	54%‡
3-6 d/daily in past week	15%	14%	39%‡	3%	21%	55%‡	13%	46%‡

PCP, Primary care provider; PAQLQ, Pediatric Asthma Quality of Life Questionnaire.

*Score >3 indicates uncontrolled asthma.

† $P \leq .001$.‡ $P < .05$.

Mean ACCI Control, missed school days, and health care use increased as the Direction measure changed from “Better” to “Worse” ($P < .05$), as Bother changed from “not bothered” to “very bothered” ($P < .01$), and as Risk changed from “no risk” to “any risk” ($P < .01$) (Table II). Similarly, mean Pediatric Asthma Quality of Life Questionnaire scores decreased ($P < .001$) across the Direction, Bother, and Risk categories. Notably, mean ACCI Control scores did not differ for those reporting “getting better” and those reporting “staying the same.” To evaluate this further, we stratified the “staying the same” group into those with controlled versus uncontrolled asthma. We found that the mean ACCI scores for these subgroups (95% CI) were distinct, with a mean score of 0.6 (0.3–0.9) for controlled and 4.3 (3.8–4.9) for uncontrolled asthma ($P < .001$). There was no association of Direction, Bother, or Risk with lung function ($P > .2$).

In summary, in this population of urban adolescents with asthma, we observed that ACCI domains of Direction (trajectory), Bother (burden), and Risk (exacerbations) are valid and distinct self-reported measures of the ACCI. The National Institutes of Health Expert Panel Report 3 guidelines recommend that health care providers assess multiple dimensions of asthma health, including control, exacerbations (risk), quality of life, pharmacotherapy, and patient-provider communication; we found that the ACCI tool is useful to evaluate 3 of these dimensions of asthma health.

Asking patients about their perception of disease trajectory may be an efficient and reasonably accurate query of disease status. Such an approach should be used cautiously, however, particularly if the patient’s response is that his or her asthma is “the same,” because it may mean that their asthma has remained poorly controlled. Therefore, the optimal approach to using the ACCI in a time- or resource-limited situation may be to assess both ACCI Direction and Control. ACCI Bother showed a robust association with quality of life in this patient population. Unlike Direction, the Bother domain showed a significant association with both measures of missed school due to asthma (past 2 weeks and the past year). Finally, our findings support the use of the ACCI Risk domain as a composite self-report measure of adolescents with asthma.

There are several limitations of this study. First, we relied on self-report data, so they are subject to reporting bias. However, self-report is a standard method for obtaining clinical information. Second, we did not observe a significant association of the Direction, Bother, or Risk measures with lung function measurements. However, lung function is known to correlate poorly with symptoms,⁶ quality of life,⁴ and airway inflammation.⁷ It is

not unreasonable to view lung function as a distinct construct, separate from Direction, Bother, and Risk. Third, these results may not be generalizable to nonurban patients. However, we included a broad cross-section of sociodemographic populations, which is a strength. Finally, as with other questionnaires, we do not know the impact of routine use of the ACCI on asthma care and outcomes.

Our findings support that ACCI Direction, Risk, and Bother are valid measures of morbidity. The ACCI may help to standardize asthma care and capture important clinical indicators of asthma morbidity in diverse adolescent populations.

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ONLINE REPOSITORY

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Asthma Control & Communication Instrument

Your name: _____ **Today's Date:** _____

When was your last asthma visit? _____ If you have never had an asthma visit, check here ☐

Please check ☒ one answer for each of the following questions.
Your answers will help your doctor give you the best asthma care.

Direction			
1. Over the past month (4 weeks), how has your asthma been?	Better 	Same 	Worse

Bothered			
2. Since Over the past month (4 weeks) how much have you been bothered by your asthma?	Not bothered 	Somewhat bothered 	Very bothered

Risk			
3-5. Over the past month (4 weeks) have you:			
3. Been to the emergency room for asthma?	No 		
4. Been hospitalized for asthma?			
5. Used prednisone (Orapred, steroid pill, steroid liquid or steroid syrup) for asthma?		Yes 	

Forget to take medicine					
6. How often do you <u>forget</u> to take your <u>daily</u> asthma medicine when you feel fine?	I am not supposed to take a daily asthma medicine 	None of the time 	Some of the time 1-2 days/week 	Most of the time 3-4 days/week 	All of the time 5-7 days/week
Daily asthma medicines include: Advair, Asmanex, , Budesonide, Dulera, Flovent, QVAR, Pulmicort, Singulair, Symbicort.					

FOR CLINICIAN USE
 If any of the answers farthest to the right or in red are selected, this may be consistent with poorly controlled and/or undertreated asthma. Further assessment and **follow-up in 2-6 weeks** is recommended.

(OVER)

FIGURE E1. This is the version of ACCI used in this study. Page 1 assesses disease trajectory (Direction), disease burden (Bother), asthma exacerbations (Risk), and adherence to controller medications. Page 2 assesses asthma control.

Asthma Symptoms	
7. Over the past week , how many days have you had asthma symptoms? For example:	Days
▪ Cough ▪ Chest tightness ▪ Shortness of breath ▪ Sputum (spit, mucous, phlegm when coughing) ▪ Difficulty taking a deep breath ▪ Wheezy or whistling sound in the chest	0 1-2 3-6 Every day (not all day long) Every day (all day long)
Reliever use	
8. Over the past week , how many days have you had to use medicine to quickly relieve asthma symptoms? For example:	Days
▪ Albuterol/Proventil/Proair/Ventolin/Xopenex via Inhaler/Spray/Pump or Machine/Nebulizer	0 1-2 3-6 Every day (not all day long) Every day (all day long)
Attacks	
9. Over the past week , how many days did you have an asthma attack? For example:	Days
▪ When it is harder to breathe for your child ▪ When you give your child more quick-relief asthma medicine (e.g., Albuterol) ▪ When the asthma medicine does not work	0 1 2-3 4-7
Activity Limitation	
10. Over the past week , how much did your asthma limit your activities?	Not at all Slightly Moderately Very much Completely
Nighttime Symptoms	
11. Over the past TWO weeks , how many nights did your asthma keep you from sleeping or wake you up?	Nights 0 1 2 3-7 8-14
12. Please write down any concerns or anything else you would like your doctor to know about <u>your child's asthma</u> .	

PLEASE GIVE THIS TO YOUR PROVIDER. Thank you.

FOR CLINICIAN USE ONLY: Control/Severity Assignment	
Controlled/ Intermittent	Partly Controlled/ Mild Persistent
Uncontrolled/ Moderate Persistent	Poorly Controlled/ Severe Persistent
Assign patient's current level of asthma control/severity by looking at the box checked <i>farthest to the right</i> on questions 7-11 and match the box color to the level of asthma control/severity in this section. Severity categories are for patients <u>not on controller therapy</u> . Control categories are for patients <u>currently taking controller therapy</u> . The <u>goal</u> for <u>all patients</u> is to have <u>controlled</u> asthma with the least amount of medication and no side effects. If asthma is <u>not controlled</u> , possible explanations include: acute respiratory infection, under-treatment with daily controller medications, poor inhaler technique, poor adherence, environmental allergies and/or exposures, comorbid conditions (see treatment algorithm on page 3). Follow-up in 2 – 6 weeks is recommended.	

FIGURE E1. (CONTINUED).