

PEDIATRIC ASTHMA

Measurement Characteristics of the Pediatric Asthma Health Outcome Measure

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Introduction. The Pediatric Asthma Health Outcome Measure (PAHOM) was designed to measure quality-adjusted life years (QALYs) in children with asthma. Our objective was to compare parent- and child-reported PAHOM scores to each other, to parent-reported scores on the Juniper Asthma Control Questionnaire (ACQ), and to physician-rated asthma control. **Methods.** A convenience sample of primarily African-American parent–child dyads ($N = 261$) was recruited from asthma clinics between May 2008 and May 2010. Correlations and differences in scores between the instruments and respondents were compared across variables of interest. The sensitivity and specificity of each, relative to physician-rated asthma control, were estimated. **Results.** Mean (SD) parent- and child-reported PAHOM scores were significantly different, 0.91 (0.13) and 0.95 (0.08), respectively, ($p < .01$) and were weakly correlated (0.24). Parent-reported PAHOM and parent-reported ACQ, 5-item version (ACQ5) scores were moderately correlated (-0.69). Both the parent- and child-reported PAHOM scores distinguished between physician-rated well-controlled and not well-controlled asthma ($p < .01$ and $p < .01$, respectively). When compared with physician-rated asthma control, the areas under the receiver operating characteristic (ROC) curves for the parent-reported PAHOM and the ACQ5 were similar ($p = .11$), but both performed better than the child-reported PAHOM (both $p < .01$). **Discussion.** The validity of the PAHOM is supported by its moderate correlation with the ACQ and its association with physician-rated asthma control. Although intended to be administered to children, parent-reported scores were better predictors of physician-rated asthma control. **Conclusions.** A validation study in a more economically and ethnically diverse population is needed. Until then, we recommend the PAHOM to be administered to both parents and children.

Keywords cost-effectiveness analysis, economic analysis, pediatric asthma, quality-adjusted life years

INTRODUCTION

Because the Pediatric Asthma Health Outcome Measure (PAHOM) prospectively measures quality-adjusted life years (QALYs) in children with asthma, it represents a potential breakthrough in the ability to conduct high-quality economic analyses in this population (1). Previously, the measurement of QALYs in children with asthma has been criticized for its lack of rigor and consistency (2). QALYs are the gold standard outcome for cost-effectiveness analyses (CEA) because they capture a health state's duration and desirableness in a single measure whose value is representative of the community's preferences. Accordingly, they are highly generalizable and can be used to compare interventions across dissimilar conditions (3).

The PAHOM was designed to measure QALYs in children 7–12 years of age with asthma by assigning them to 1 of 10 health states for each of the past 7 days (1). Each health state is assigned a preference weight that represents the desirableness of that health state on an interval scale bounded by 0 (death) and 1 (perfect health). These standard gamble-derived weights are based on a hypothetical treatment decision where the outcome is either cure or death. The willingness of respondents in the community to accept some risk of death to cure a child's asthma is used to establish the preference weight; the greater the accepted risk, the lower the health state's desirableness, and hence, the lower its preference weight.

Our interest in CEA led us to investigate the PAHOM's measurement characteristics in an ongoing clinical trial of children with asthma. We had two primary questions. First, would the PAHOM yield similar responses when administered to children as when administered to parents? Because it requires respondents to recall their health status on specific days rather than globally over a period of time, it seemed to impose a significant cognitive burden on the

The work was performed at the University of Alabama at Birmingham and the University of Arizona.

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young children for which it was designed. Second, could the PAHOM differentiate between well-controlled and not well-controlled asthma? Because its questions are similar to those used to assess asthma control, establishing its comparableness to an existing asthma control measure would provide additional evidence of this instrument's validity (4).

METHODS

Recruitment

This analysis was part of a larger study examining the impact of parental health literacy on childhood asthma (HRSA MCH 5 R40MC08728). A total of 261 primarily African-American parent-child dyads were recruited between May 2008 and May 2010 from asthma clinics affiliated with the Children's Health System of Alabama and general pediatric clinics affiliated with the Jefferson County Health Department. All asthma clinic participants were recruited during scheduled visits; however, some participants from general pediatric clinics were recruited by telephone and/or mail. Children had to be between 6 and 12 years of age and had to have physician-diagnosed asthma; parents had to be native English speakers. Parents provided informed consent and children provided written assent. The study was approved and monitored by the Institutional Review Boards at the University of Alabama at Birmingham and the University of Arizona.

PAHOM Data Collection

The 4-item PAHOM was interviewer-administered on the same day during separate interviews to each child and one parent. These interviews occurred after the physician visit and physicians were blinded to the results. Children (parents) were asked, "For each day of the past 7 days, did you (your child) (1) go to the hospital or visit the doctor because you (he/she) were (was) sick with asthma, (2) not go to the hospital or doctor's office, but had asthma symptoms such as wheezing, tightness in the chest, shortness of breath, cough, or awakening during the night because of these symptoms, (3) feel different or left out because of asthma, and (4) have to slow down your (his/her) normal activities or exercise because of asthma." If a parent or child responded "yes" to question 1, then the response to question 2, by definition, was "no." When a parent or child could not remember a specific response, the default answer was "no."

PAHOM Scoring

Children were assigned to 1 of 10 possible health states (two health states (s_3 , e_1 , and a_1) and (s_3 , e_2 , and a_1) were deemed not possible by the instrument developers) for each day of the past 7 days based on the presence or absence of impairment in three domains: symptoms (s_1 , s_2 , or s_3), emotional impairment (e_1 or e_2), and activity limitation (a_1 or a_2) (Table 1). Each health state was associated with a unique preference weight. For example, a day with no symptoms, no emotional impairment, and no

TABLE 1.—PAHOM health states, preference weights, and distribution of health state days by child ($N = 261$) and parent responses ($N = 261$).

Health state	Preference weight	Days (%)	
		Child, $n = 1817^b$	Parent, $n = 1826^a$
s_1 , e_1 , a_1	1.0	1290 (71)	1067 (58)
s_2 , e_1 , a_1	0.96	207 (11)	302 (17)
s_1 , e_2 , a_1	0.89	46 (3)	18 (1)
s_1 , e_1 , a_2	0.85	134 (7)	122 (7)
s_2 , e_2 , a_1	0.76	12 (1)	7 (1)
s_2 , e_1 , a_2	0.71	56 (3)	179 (10)
s_1 , e_2 , a_2	0.64	13 (1)	25 (1)
s_3 , e_1 , a_2	0.49	38 (2)	23 (1)
s_2 , e_2 , a_2	0.37	18 (1)	74 (4)
s_3 , e_2 , a_2	0.06	3 (1)	9 (1)

Notes: ^a1 day missing. ^b10 days missing.

activity limitation (s_1 , e_1 , and a_1) was associated with a preference weight of 1. This health state was also defined as an asthma symptom-free day (ASFD). The PAHOM score was the mean daily preference weight for the 7-day period.

ACQ Data Collection

The Asthma Control Questionnaire (ACQ) consisted of 7 items (6 questions plus spirometry; ACQ7) that assessed symptoms, activity limitation, β -agonist use, and lung function (forced expiratory volume in 1 second or FEV₁) (4). The recall period was 1 week assessed globally rather than day by day as in the PAHOM. Spirometry was performed by a respiratory therapist or trained study nurse in accordance with American Thoracic Society (ATS) recommendations (5).

The study protocol called for the ACQ to be interviewer-administered to parents, not children. Our methodology was consistent with the data available to us at the time of study which suggested that ACQ results in children <10 years of age were more predictive of asthma control when parent responses were used (6). Since that time, interviewer administration directly to children 7–10 years of age with the option of parental assistance has become the recommended strategy (7–9).

ACQ Scoring

Individual questions were rated on a 7-point Likert scale with higher scores reflecting worse outcomes. The ACQ was scored using the 5-symptom questions (ACQ5), the 5-symptom questions plus short-acting β -agonist use (ACQ6), and the previous 6 items plus FEV₁ (ACQ7). Three recommended cut-points (0.75, 1.0, and 1.5) can be used to distinguish between well-controlled and not well-controlled asthma (10).

Physician-Rated Control

The child's primary asthma physician was asked to rate the child's asthma control at the time of the visit as well-controlled, not well-controlled, or poorly controlled. The latter two categories were collapsed since few were rated as having poorly controlled asthma. The determination of

control status was based on the physician's judgment following a comprehensive medical history, physical examination, and spirometry. All physicians were experienced asthma providers and were cognizant of the recommendations from the National Asthma Education and Prevention Program (NAEPP) (11).

Statistical Analysis

Means (continuous) or frequencies (categorical) for demographic variables were calculated, overall and by various demographic categories. The mean PAHOM and ACQ scores were compared using the Spearman's rank correlation. The distributions of the PAHOM and ACQ scores by various demographic categories were compared using the Kruskal–Wallis test.

Logistic regression was used to fit receiver operating characteristic (ROC) curves comparing PAHOM and ACQ scores against the gold standard of physician-rated control. Likewise, child-reported PAHOM scores by age (6–7 years, 8–10 years, and 11–12 years) were compared against physician-rated control. ROC curves are two-dimensional graphs that plot the true positive rate (y-axis) and the false positive rate (x-axis) of a diagnostic test (12). Diagnostic tests with greater accuracy have lines that are skewed toward the upper left-hand corner (northwest quadrant) of the graph, above and away from a diagonal line which represents the outcomes expected of random guessing.

RESULTS

This sample represented primarily well-educated, but low-to-moderate income, African-American, working mothers whose children were insured by Medicaid. Most children had mild or moderate persistent asthma and approximately half were well-controlled at the time of the interview. Specific parent and child characteristics are presented in Table 2.

The mean (SD) parent-reported PAHOM score, 0.91 (0.13), was significantly lower than the child-reported score, 0.95 (0.08) ($p < .01$), indicating that parents rated their child's asthma as being worse than their child did. These scores were weakly correlated (0.24). The parent-reported PAHOM scores were moderately correlated with the parent-reported ACQ5, ACQ6, and ACQ7 scores: -0.69 , -0.69 , and -0.67 , respectively. Because the correlations between the parent-reported PAHOM and the three ACQ versions were consistent, only correlations with the ACQ5 are shown in Table 2.

The ASFD (s_1 , e_1 , and a_1) was the most commonly reported health state, accounting for 58% of all days reported by parents and 71% of all days reported by children (Table 1). When each PAHOM question was examined separately, parents reported more days with symptoms (s_2), activity limitation (a_2), and emotional impairment (e_2) than children, but slightly fewer days with symptoms and health-care visits (s_3) (Figure 1).

Significantly lower parent-reported PAHOM and ACQ5 scores were observed among children of non-White parents ($p = .02$ and $p < .01$, respectively), children with Medicaid ($p = .01$ and $p < .01$, respectively), and children from lower-income households ($p < .01$ and $p < .01$, respectively) (Table 2). As requested in the review process, we also examined the association between race, income, insurance status, and physician-rated asthma control using a logistic regression model. It demonstrated that only race was independently associated with physician-rated not well-controlled asthma (OR 4.9; 1.5, 15.9). On the ACQ5, lower scores were also observed among children of parents with lower educational attainment ($p < .01$). The only significant difference observed on the child-reported PAHOM was that children with lower FEV₁ had lower scores ($p = .05$). Lower FEV₁ was also associated with worse scores on the parent-reported PAHOM ($p = .04$) and the ACQ7 ($p < .001$), but not the ACQ5 ($p = .11$) or ACQ6 ($p = .07$).

Across multiple subgroup comparisons, parents unequivocally reported lower PAHOM scores than children (Table 2). However, some subgroups seemed to demonstrate greater consistency between parent and child scores including children of White ($p = .21$) or high-income ($p = .92$) parents, children who were covered by private insurance ($p = .59$), children with intermittent asthma ($p = .50$), and children with the lowest lung function ($p = .29$).

When parent-reported PAHOM and ACQ5 scores were compared across different levels of reported health care utilization in the past year, both demonstrated significantly worse scores for children who had ≥ 1 physician visits ($p < .01$ and $p < .01$, respectively) and ≥ 1 school absence ($p < .01$ and $p < .01$, respectively), but not for children with ≥ 1 emergency department (ED) visits ($p = .29$ and $p = .09$, respectively) or ≥ 1 hospitalizations ($p = .56$ and $p = .90$, respectively). There were no differences across reported levels of health-care utilization on the child-reported PAHOM. Interestingly, asthma severity was not associated with worse asthma outcomes on the parent-reported PAHOM ($p = .73$), child-reported PAHOM ($p = .24$), or the ACQ5 ($p = .32$).

Each of the instruments exhibited significantly different mean scores for children with physician-rated well-controlled asthma versus those with not well-controlled asthma (all $p < 0.001$) (Table 2). While the mean (SD) parent- and child-reported PAHOM scores for well-controlled asthma were similar, 0.95 (0.09) and 0.96 (0.06), respectively, the mean (SD) parent-reported score for children with not well-controlled asthma, 0.87 (0.14), was significantly lower than the child-reported score, 0.93 (0.09) ($p < .01$).

When compared against physician-rated control, the area under the ROC curve for the parent-reported PAHOM, 0.7396, was significantly greater than the child-reported PAHOM, 0.6240 ($p < .01$), indicating that the parent responses were more accurate (Figure 2). This was also true at each level of child age (6–7 years, 8–10 years, and 11–12 years). There were no significant

TABLE 2.—Means (SD) and correlations between parent- and child-reported PAHOM scores and between parent-reported PAHOM and ACQ5 scores.

	<i>N</i> (%)	PAHOM Child Mean (SD)	PAHOM Parent Mean (SD)	<i>p</i>	<i>r</i>	ACQ5 Parent Mean (SD)	<i>r</i>
Overall	261 (100)	0.95 (0.08)	0.91 (0.13)	<.01	0.24	1.6 (1.2)	−0.69
Child characteristics ^a							
Gender							
Boys	166 (64)	0.95 (0.07)	0.91 (0.12)	<.01	0.16	1.7 (1.1)	−0.7
Girls	95 (36)	0.94 (0.10)	0.91 (0.15)	.03	0.36	1.6 (1.2)	−0.66
<i>p</i> -Value		.1	.35			.41	
Age							
<8 years	110 (28)	0.94 (0.09)	0.91 (0.12)	.03	0.14	1.8 (1.2)	−0.64
8–10 years	87 (48)	0.96 (0.08)	0.91 (0.12)	<.01	0.25	1.4 (1.1)	−0.74
>10 years	64 (24)	0.96 (0.07)	0.91 (0.15)	<.01	0.4	1.6 (1.1)	−0.69
<i>p</i> -Value		.1	.78			.07	
Insurance ^b							
None	6 (2)	0.96 (0.03)	0.90 (0.05)	.02	0.26	1.8 (0.70)	−0.94
Public	209 (80)	0.95 (0.08)	0.90 (0.14)	<.01	0.26	1.7 (1.2)	−0.65
Private	45 (19)	0.96 (0.06)	0.95 (0.07)	.59	0.18	1.1 (1.1)	−0.79
<i>p</i> -Value		.95	.01			<.01	
Severity ^b							
Intermittent	13 (5)	0.92 (0.09)	0.96 (0.05)	.5	0.05	1.7 (0.94)	−0.59
Mild	97 (38)	0.96 (0.06)	0.93 (0.08)	.01	0.2	1.6 (1.1)	−0.63
Moderate	125 (48)	0.95 (0.08)	0.91 (0.13)	<.01	0.21	1.6 (1.2)	−0.72
Severe	23 (9)	0.91 (0.12)	0.84 (0.22)	.05	0.58	2.1 (1.3)	−0.8
<i>p</i> -Value		.24	.73			.32	
FEV ₁ ^b							
≥80%	175 (69)	0.95 (0.08)	0.92 (0.12)	<.01	0.26	1.5 (1.2)	−0.7
60–79%	67 (26)	0.96 (0.05)	0.90 (0.12)	<.01	0.01	1.8 (1.1)	−0.58
<60%	14 (5)	0.88 (0.13)	0.82 (0.18)	.29	0.51	2.1 (1.5)	−0.79
<i>p</i> -Value		.05	.04			.11	
MD-rated control							
Well-controlled	132 (53)	0.96 (0.06)	0.95 (0.09)	.18	0.25	1.1 (0.93)	−0.6
Not well-controlled	117 (47)	0.93 (0.09)	0.87 (0.14)	<.01	0.14	2.2 (1.1)	−0.61
<i>p</i> -Value		<.01	<.01			<.01	
Parent characteristics ^a							
Race							
White	37 (14)	0.96 (0.05)	0.94 (0.11)	.21	0.36	1.1 (1.3)	−0.74
Non-White	224 (86)	0.95 (0.08)	0.91 (0.13)	<.01	0.23	1.7 (1.1)	−0.65
<i>p</i> -Value		.14	.02			<.01	
Education							
<HS	41 (16)	0.93 (0.08)	0.88 (0.18)	.05	0.22	2.1 (1.2)	−0.79
HS	108 (38)	0.95 (0.08)	0.91 (0.12)	<.01	0.18	1.8 (1.2)	−0.64
>HS	112 (47)	0.95 (0.08)	0.92 (0.11)	<.01	0.32	1.4 (1.1)	−0.72
<i>p</i> -Value		.16	.6			<.01	
Income ^b							
<\$20,000	127 (49)	0.95 (0.07)	0.90 (0.14)	<.01	0.11	1.9 (1.1)	−0.69
\$20,000–59,999	78 (25)	0.95 (0.09)	0.92 (0.12)	.06	0.25	1.4 (1.2)	−0.69
≥\$60,000	16 (11)	0.97 (0.05)	0.98 (0.05)	.92	0.24	0.73 (1.0)	−0.51
<i>p</i> -Value		.36	<.01			<.01	
Employment ^b							
Full time	133 (52)	0.94 (0.09)	0.92 (0.13)	.02	0.18	1.6 (1.2)	−0.7
Part time	41 (16)	0.95 (0.09)	0.90 (0.11)	.05	0.35	1.9 (1.2)	−0.59
At home	76 (30)	0.96 (0.05)	0.90 (0.14)	<.01	0.34	1.7 (1.1)	−0.7
Student	7 (3)	0.95 (0.06)	0.85 (0.17)	.15	0.52	1.2 (0.89)	−0.66
<i>p</i> -Value		.64	.35			.32	

Notes: ACQ, Asthma Control Questionnaire; MD, medical doctor; PAHOM, Pediatric Asthma Health Outcome Measure.

^aDoes not add to totals, due to missing data.^bBold values represent within-column associations with $p < .05$.

differences between child-reported scores by child age (not shown). There were also no significant differences observed between the three ACQ versions (not shown). The area under the ROC curve for the parent-reported PAHOM was similar to that of the ACQ5, 0.7834

($p = .11$), indicating that both were similarly accurate. The ACQ5 was also more accurate than the child-reported PAHOM ($p < .01$). The sensitivity and specificity for the child- and parent-reported PAHOM and the three ACQ versions are shown in Table 3.

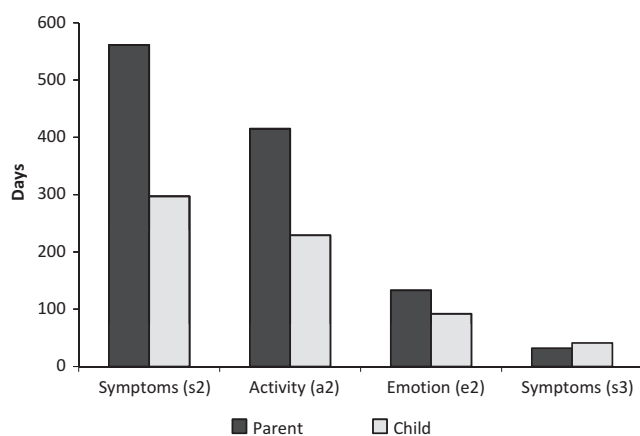


FIGURE 1.—Number of days reported with symptoms (s_3 and s_2), activity limitation (a_2), and emotional impairment (e_2) among parents and children ($N = 1816$).

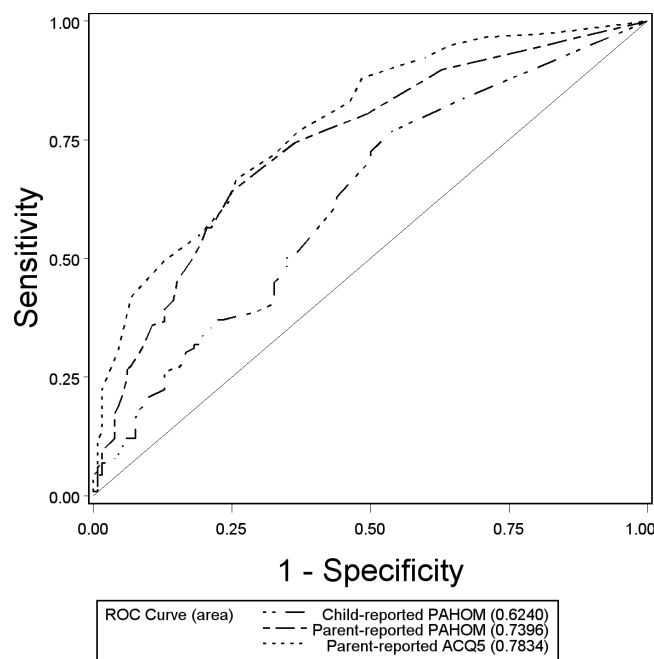


FIGURE 2.—Receiver operating characteristic (ROC) curves for parent- and child-reported PAHOM and ACQ5 scores to identify not well-controlled asthma as compared to physician-rated control.

DISCUSSION

The NAEPP recommends that symptoms, short-acting beta agonist (SABA) use, lung function, and exacerbation risk be used to assess asthma control in children (11). Both the PAHOM and ACQ5 assess symptom burden, but only the PAHOM captures exacerbation history while only the ACQ6 and ACQ7 capture SABA use and lung function, respectively. Despite these differences, the measurement characteristics of PAHOM were comparable to all the three versions of the ACQ, particularly when parent responses were used. However, important differences were observed when parent and child PAHOM responses were compared. Parents tended to report lower scores indicating that they viewed their child's asthma to be worse than their child

TABLE 3.—Sensitivity and specificity of ACQ and PAHOM to identify not well-controlled asthma as compared to gold standard of physician evaluation.

		Sensitivity % (CI _{95%})	Specificity % (CI _{95%})
PAHOM (parent)	<1	90 (82, 94)	37 (29, 46)
	<0.98	78 (69, 85)	54 (45, 62)
	<0.96	68 (58, 76)	67 (59, 75)
PAHOM (child)	<1	84 (75, 90)	33 (26, 42)
	<0.98	71 (61, 79)	50 (41, 59)
	<0.96	41 (32, 51)	67 (58, 74)
ACQ5 (parent)	<0.75	92 (86, 96)	40 (32, 49)
	<1.0	88 (80, 93)	52 (43, 60)
	<1.5	72 (63, 80)	67 (59, 75)
ACQ6 (parent)	<0.75	93 (87, 97)	41 (33, 50)
	<1.0	86 (79, 92)	51 (42, 60)
	<1.5	74 (64, 81)	65 (56, 73)
ACQ7 (parent)	<0.75	93 (87, 97)	38 (30, 47)
	<0.0	90 (82, 94)	43 (35, 52)
	<1.5	70 (61, 78)	66 (57, 74)

Note: ACQ, Asthma Control Questionnaire; CI_{95%}, 95% confidence interval; PAHOM, Pediatric Asthma Health Outcome Measure.

did. These differences were primarily attributable to parents reporting more days with symptoms and more days with activity limitation. When these responses were compared against the gold standard of physician-rated control, parent responses more accurately predicted a physician's rating of not well-controlled asthma than child responses did. This suggests that parent responses are more valid; however, it is also possible that the physician simply relied more heavily on the parent as a source of information during the medical interview.

Previous comparisons of parent and child responses on various symptom, quality of life (QoL), and health-care utilization questionnaires have been reported (6, 13–20). Most demonstrate statistically significant, but not practically meaningful, differences between parent and child responses. Parents and children generally agree when asked about salient events such as a previous asthma diagnosis or recent ED visit or hospitalization (17–20). However, children almost invariably report more symptoms (14, 15, 17–20) and lower QoL (13, 16) than parents.

Our results were opposite; parents reported more days with symptoms, activity limitation, and emotional impairment than their children (Figure 2). Because the PAHOM requires children to recall their exact health status in the three domains — symptoms, activity, and emotion — for each day of the past week, it may exceed their cognitive capacity to effectively discriminate differences in impairment over time. Previously, we compared daily diary reporting with PAHOM recall in elementary school children (21). We found that agreement between the two declined precipitously after 2-day recall. By a 4-to-1 margin, children underreported symptoms on PAHOM recall when compared with the same days on the daily diary. Because of this, we tend to believe that cognitive burden is a plausible explanation for the observation that children reported fewer symptom days than their parents and why their parent's responses more accurately predicted physician-rated control.

Because the magnitude of differences between parent and child PAHOM responses across the three categories of age (6–7 years, 8–10 years, and 11–12 years) were qualitatively similar, we believe that symptom underreporting could be a problem for all children for whom the PAHOM was intended to be administered. This is supported by the observation that parent responses were more predictive of physician-rated control when compared with child response among all the three age categories. Because of these observations, we would recommend that the PAHOM be administered to both children and parents until more definitive information becomes available regarding the most accurate respondent.

The risk of using child-reported PAHOM scores is that they could make it more difficult to establish the cost-effectiveness of interventions targeting children with asthma. Because child scores tend to be closer to 1, there is less potential improvement to be made even if an intervention is efficacious. We previously demonstrated in a Markov simulation of school-based asthma screening that small changes in PAHOM scores, similar in magnitude to those observed here, could substantially impact the cost-effectiveness estimate (22). While not definitive, our cross-sectional data raise important concerns regarding the administration of the PAHOM as designed to children between 7 and 12 years of age. Doing so could inadvertently disadvantage them by underestimating the true value of childhood asthma interventions.

Our analyses also reaffirmed the previously identified associations between asthma control and race, in particular, but also socioeconomic status (23–28). As expected, non-White race, low income, low parental educational attainment, and lack of private insurance were all associated with worse asthma control on the ACQ. The comparability of the ACQ and parent-reported PAHOM is further evidenced by the fact that the PAHOM also detected differences by race, income, and insurance status. The associations between these factors and asthma control along with a small number of participants who were White, high income, and privately insured provided us little power to detect differences between parent and child PAHOM responses among privately insured children or those White or high-income parents. In summary, the observed differences in PAHOM scores, particularly among parents, are likely explained by the child's underlying asthma control status and its association with measurable characteristics such as race and not features unique to the instrument itself.

Several limitations should be noted. Because we did not administer the ACQ to children, we were unable to make a true 4-by-4 comparison. Although our administration to parents was consistent with contemporary practice, it deviated from subsequent guidance which recommended administration to children with the option of parental assistance (7, 29). It is possible to compare our parent-reported ACQ5 sensitivity and specificity for physician-rated asthma control with child-reported ACQ5 sensitivity and specificity for daily diary-rated asthma control (10). At a cut-point of 1.0, our methodology was more sensitive

(88% vs. 69%, respectively), but less specific (52% vs. 81%, respectively). Unfortunately, it is not possible to disentangle whether the differences are due to different respondents (parents vs. children) or to different gold standards (physician-rated vs. daily diary-rated control).

This study also relied on a convenience sample of mostly African-American children from low-to-moderate income families who were insured by Medicaid. Therefore, the generalizability of our results to other populations is limited. However, the current emphasis of asthma research on high-risk populations like ours makes our results quite relevant to understanding the economic value of interventions targeting this population.

We draw three conclusions from our results. Although the PAHOM was intended to be administered to children of 7–12 years of age, parental responses were better predictors of physician-rated control. Because the differences between scores are relatively large, they could substantially bias cost-effectiveness estimates. The primary concern is that using child responses could make it more difficult to establish that asthma interventions targeting children are cost-effective. Second, the comparability of the parent-reported PAHOM and ACQ scores and their ability to predict physician-rated control support the convergent validity of the PAHOM instrument. While the PAHOM was designed to measure QALYs, it also captures important determinants of asthma control. Lastly, a larger validation study among a population with greater socioeconomic and ethnic diversity is urgently needed.

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The authors' contributions are as follows: Joe Gerald: guarantor of entire manuscript, data analysis, manuscript preparation; Leslie McClure: study design, statistical analysis, manuscript preparation; Kathy Harrington: study administration, data management/collection, manuscript preparation; Teri Moore: literature review, manuscript preparation; Ana Celia Hernández-Martínez: literature review, manuscript preparation; and Lynn Gerald: study design, study administration/oversight, manuscript preparation.

DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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