

# Make an M-PACT on Asthma

## *Rapid Identification of Persistent Asthma Symptoms in a Pediatric Emergency Department*

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**Objective:** To develop and validate a brief assessment instrument for persistent asthma symptoms in a pediatric emergency department (ED) population.

**Methods:** Parents of children aged 1 to 18 years being discharged home after treatment for acute asthma in an urban children's hospital completed a 6-item screen for persistent symptoms that had been developed from national guidelines and previously validated. During a follow-up phone call 4 weeks after the ED visit, the instrument was repeated. An 8-item asthma-related quality-of-life (ARQOL) instrument was also administered at both times to assess construct validity. Item analysis assessed the performance of individual items and their combination versus the full instrument.

**Results:** Four hundred thirty-three children were enrolled, and 361 patients (83%) had complete data. Sensitivity and predictive value were calculated for the full screen and combination of items in detecting persistent symptoms at baseline and follow-up. A 3-item version included symptoms with activity, symptoms at night, and need for rescue albuterol. This version was 96% sensitive (95% confidence interval, 92–99) for persistent symptoms compared with the 6-item screen, and 69% (95% confidence interval, 62–76) of the participants continued to report persistent symptoms 4 weeks after the visit. For both screens, subjects with persistent symptoms had significantly worse ARQOL score at baseline and follow-up.

**Conclusions:** A brief screen can identify persistent symptoms in pediatric ED patients with good sensitivity compared with a longer instrument. Most of these patients will continue to report persistent symptoms and reduced ARQOL score 1 month after the ED visit and may be candidates for additional interventions in the ED to improve long-term asthma care.

**Key Words:** asthma, asthma control tool, persistent asthma

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Asthma is the most common chronic disease of childhood and has emerged as a leading public health problem. Prevalence, emergency visits, hospitalizations, and racial disparities have increased substantially, especially among young children and urban populations.<sup>1,2</sup> The National Asthma Education

and Prevention Program (NAEPP) guidelines published by the National Heart, Lung, and Blood Institute have existed for more than 15 years and were recently updated in 2007.<sup>3</sup> These guidelines outline evidence-based recommendations for the management of asthma based on levels of severity ranging from intermittent to severe persistent asthma. Children with poorly controlled asthma exhibit persistent symptoms, defined as symptoms that occur during the daytime more than twice per week or at night more than twice per month. The NAEPP recommends preventive controller medications for these children with persistent asthma. In recent studies from urban pediatric emergency departments (EDs), a substantial proportion of children report symptoms consistent with persistent asthma (38%–73%), but more than half are not using recommended controller medications before the ED visit.<sup>4–8</sup>

Prior interventions designed to improve follow-up with primary care providers (PCPs) after an ED asthma visit have had limited success in improving long-term outcomes.<sup>8,9</sup> The new NAEPP guidelines suggest that emergency physicians should consider initiating inhaled corticosteroids (ICSs) to patients after an acute exacerbation.<sup>3</sup> However, standardized methods to screen for persistent asthma symptoms in the ED setting are not widely available. The NAEPP guidelines provide sample assessment questions but note that these items have not been formally evaluated. Existing instruments do not link directly to the NAEPP classification categories and have not been validated in the ED setting.<sup>10–13</sup> A prior publication described the development of a pediatric asthma control tool (PACT) to help in the identification of persistent asthma according to the NAEPP guidelines.<sup>14</sup> This instrument was generated through a process of literature review, meetings of institutional experts, and focus groups of parents and providers and validated in a specialty clinic population. In this study, we sought to apply this instrument in the pediatric ED setting to develop a brief screen for persistent asthma symptoms that would identify children in need of further intervention to improve long-term asthma care.

The goal of this study was to determine the sensitivity of measuring asthma control using items derived from the PACT. We compared responses to a baseline interview completed at the ED visit with a follow-up interview 4 weeks later and correlated these responses with an asthma-related quality-of-life questionnaire to assess construct validity.

## METHODS

### Design

Prospective cohort study carried out as part of a larger clinical trial.

### Setting/Participants

The study was conducted in an urban children's hospital ED with approximately 78,000 annual visits, of which more than 5000 are for asthma. Institutional review board approval and informed consent were obtained before enrollment. The study

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### Mini Pediatric Asthma Control Tool (M-PACT)

Please take time to fill out this checklist. This checklist can help doctors and nurses (and you!) to know how to best help your child manage his or her asthma.

- Children may have different *signs* of asthma.
- Signs of asthma get worse during an asthma flare (also known as an attack or exacerbation)

What are the signs of asthma for your child? (check all that apply)

- Coughs
- Wheezes (a whistling in the chest)
- Gets mucus in his or her chest
- Gets short of breath
- Feels chest pain or tightness
- Breathes fast

Think about the past 3 months

- How often did these things happen when your child was feeling his or her best and not having an asthma flare? (check one)

	Never	Once or twice a month	Once or twice a week	Every other day	Every day	More than once a day
1. Asthma symptoms with running or sports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Asthma symptoms while asleep at night	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. He or she needed to take albuterol or other quick-relief medicine for asthma symptoms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Responses in the shaded area above indicate the presence of ***persistent asthma*** symptoms

### Asthma Control Tool

Please take time to fill out this checklist. This checklist can help doctors and nurses (and you!) to know how to best help your child manage his or her asthma.

- Children may have different *signs* of asthma.
- Signs of asthma get worse during an asthma flare (also known as an attack or exacerbation)

What are the signs of asthma for your child? (check all that apply)

- Coughs
- Wheezes (a whistling in the chest)
- Gets mucus in his or her chest
- Gets short of breath
- Feels chest pain or tightness
- Breathes fast

Think about the past 3 months

- How often did these things happen when your child was feeling his or her best and not having an asthma flare? (check one)

	Never	Once or twice a month	Once or twice a week	Every other day	Every day	More than once a day
1. Asthma symptoms while sitting quietly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Asthma symptoms with light activity such as walking up steps or laughing or crying	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Asthma symptoms with running or sports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Asthma symptoms while asleep at night	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Asthma symptoms in the morning when he or she woke up	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. He or she needed to take albuterol or other quick-relief medicine for asthma symptoms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Responses in the shaded area above indicate the presence of ***persistent asthma*** symptoms

FIGURE 1. Mini-PACT and PACT.

enrolled ED patients discharged after treatment for acute asthma. Subjects were identified by ED staff and approached by trained research assistants who are present in the ED from 8 AM to midnight each day. Inclusion criterion was a diagnosis of asthma, defined as a history of 2 or more separate prior episodes of treatment with a bronchodilator medication by a health provider. Children with underlying cardiac or another chronic lung disease (eg, cystic fibrosis) were excluded. Because the focus of the study was on urban children with asthma, those living outside city limits were excluded.

**Methods**

This was a prospective cohort study carried out as part of a larger, institutional review board–approved clinical trial studying an educational intervention to improve primary care follow-up after an ED visit. As part of asthma symptom screening for the study, parents of enrolled children completed the PACT. The PACT is a 10-question screen of asthma control that was validated in a prior study in a subspecialty clinic population.<sup>14</sup> Five of the questions determine categorization for persistent asthma according to the NAEPP guidelines, and these were the focus of this study; 1 additional item from a longer version of PACT regarding symptoms at rest was also included for a total of 6 items (Fig. 1). During a follow-up phone call 4 weeks after the ED visit, the instrument was repeated, focusing on the time period since the ED visit. An 8-item asthma-related quality-of-life instrument by Buckstein et al<sup>15</sup> was also administered at the ED visit and follow-up call to assess construct validity. Item analysis assessed the performance of individual items and their combination versus the full instrument. Symptoms were dichotomized into intermittent and persistent based on the NAEPP guidelines, which define persistent symptoms based on frequency. Quality-of-life scores were summed and calculated as a percentile as described by Buckstein et al.<sup>15</sup>

**RESULTS**

A total of 433 patients were enrolled between March and December 2005. Table 1 lists the characteristics of the study population. Follow-up phone calls were completed for 385 (89% completion rate), of which 361 (83%) had complete data at both baseline and 4-week follow-up. Reported use of ICSs before the ED visit was 60%, higher than the 38% rate reported in a prior study in this population,<sup>4,8</sup> and only 8% of patients with persistent symptoms had ICS initiated during the ED visit.

The full screen and combination of items in detecting persistent symptoms at baseline and follow-up are presented in Table 2. Study data were tabulated and mean values and percentages calculated using a standard software (SPSS 16, Chicago, Ill). Item analysis assessed the performance of individual items and their combination versus the full instrument. In the main analysis, we evaluated the performance of the mini-PACT (M-PACT; Fig. 1) in identifying patients with persistent

**TABLE 1.** Characteristics of Enrolled Subjects

Demographics of Subjects Enrolled	n = 361
Male	232 (64%)
Age, mean (SD)	6.6 (4.4)
Race, African American	336 (93%)
Urgent PCP visit for asthma in the past 12 mo	219 (61%)
ED visit for asthma in the past 12 mo	270 (75%)
Baseline ICS use	216 (60%)
Persistent asthma	181 (50%)

**TABLE 2.** Prediction of Persistent Asthma Symptoms

	Baseline ED Visit	4-wk Follow-Up	
	Sensitivity (95% CI)	Sensitivity (95% CI)	Positive Predictive Value (95% CI)
6-Item screen <sup>14</sup>		70 (63–77)	66 (59–73)
3-Item screen M-PACT	96 (92–99)	69 (62–76)	67 (60–74)

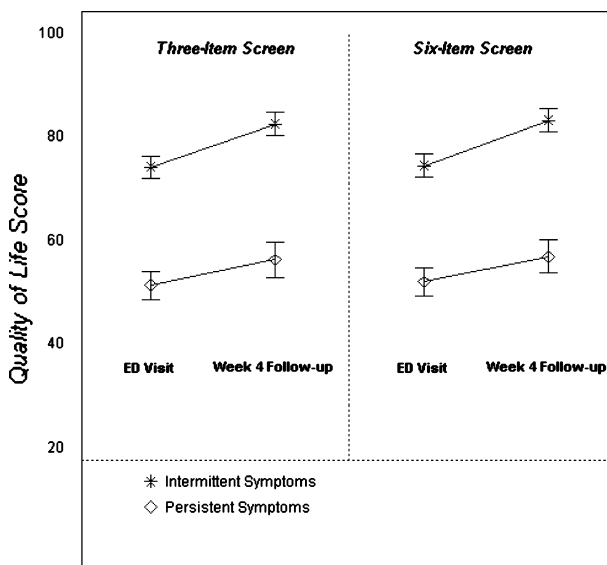
asthma symptoms. Univariate discriminant analysis revealed the following 3 items to be most predictive of persistent asthma: (1) symptoms with activities such as running or during sports, (2) symptoms while asleep, and (3) use of rescue albuterol. The validity of each survey item as a case-detection tool for asthma was evaluated through calculation of standard parameters: sensitivity, specificity, and positive and negative predictive values.

A 3-item version included symptoms with activity, symptoms at night, and need for rescue albuterol. This version was 96% sensitive (95% confidence interval [CI], 92–99) for persistent symptoms compared with the 6-item screen, and 69% (95% CI, 62–76) continued to report persistent symptoms 4 weeks after the visit.

Quality-of-life scores were summed and calculated as a percentile as described by Bukstein et al<sup>15</sup> and correlated with baseline symptom scores for construct validity. A higher score on the instrument demonstrated better quality of life. For all 3 screens, subjects with persistent symptoms had significantly worse asthma-related quality of life at baseline and follow-up compared with those who screened negative for persistent symptoms (Fig. 2).<sup>16</sup>

**DISCUSSION**

This study of urban children discharged after treatment in the ED for an asthma exacerbation found that a brief 3-item screen detected persistent asthma symptoms in almost as many children (96%) as a longer screening instrument that had been previously validated. Most children (69%) who screened positive



**FIGURE 2.** Asthma-related quality of life and persistent asthma symptoms at baseline ED visit and 4-week follow-up.<sup>16</sup>

for persistent symptoms in the ED continued to experience these symptoms when parents were surveyed by phone 1 month after the ED visit. In addition, children who were found to have persistent asthma had significantly worse asthma-related quality of life both in the ED and at the time of the follow-up call as compared with children who screened negative for persistent symptoms.

Our findings were consistent with prior studies documenting a substantial burden of chronic asthma symptoms among urban children being treated for an acute exacerbation in an ED. Caregivers reported persistent asthma symptoms for half of children at the time of the ED visit, as observed in prior studies.<sup>6,7</sup> Although reported use of controller medications before the ED visit has increased since prior studies on this population of patients (60% vs 38%),<sup>8</sup> a large percentage of the participants who reported use of controller medications such as ICS (55%) still reported persistent asthma symptoms, likely reflecting noncompliance, undertreatment with these medicines, or other potential factors.<sup>7</sup> Mean quality-of-life scores that we observed were consistent with those described by Kwok et al<sup>17</sup> who found a similar correlation with asthma severity classification.

Our results expand on previous studies by providing a simple instrument based on the NAEPP criteria that can be used in the ED setting. Population-based studies have found poor adherence to these guidelines, particularly in urban populations at high risk for poor outcomes such as ED visits.<sup>18,19</sup> By definition, our tool gives a conservative estimate of asthma control because it asks for symptoms at best during the 3 months before the exacerbation using the NAEPP guideline criteria. This is appropriate for the ED setting where one limitation may be over-reporting of symptoms during an asthma exacerbation. When repeated 1 month after the ED visit and focused on that period, most families continued to report persistent symptoms, indicating a significant potential for improvement in chronic care.

Potential benefits of screening for persistent asthma symptoms in the ED include interventions that can improve long-term outcomes. Recent research has demonstrated that subsequent unscheduled visits and quality of life can improve in urban asthmatic children after ED-based follow-up care that combines education and initiation of controller medications.<sup>20</sup> However, primary care follow-up rates have been low in urban populations, and interventions focused on improving follow-up with an existing PCP have not been successful in improving outcomes.<sup>8,21</sup> To address this concern, the most recent NAEPP guidelines recommend that ED physicians consider initiating controller medications in the ED. However, when surveyed, ED physicians report infrequently taking this step.<sup>22,23</sup> In our study, only 8% of children not on controller medications identified as having persistent symptoms had ICS initiated at ED discharge. A recent study of ED initiation of ICSs found that a substantial proportion of patients continued to use these medications subsequent to the ED visit.<sup>24</sup> Future research should further assess this practice, and a validated screening instrument for persistent symptoms is an essential tool for this research.

Our study had a number of limitations. Assessment of asthma control is a subjective process, and there is currently no criterion standard against which to judge a screening instrument. The criterion standard used in this study has not been validated in ED populations. However, the instrument we used had been developed from standard definitions in the NAEPP guidelines and validated in a prior study against assessment of control by a subspecialist. The most recent 2007 NAEPP guidelines expand the concept of persistent asthma beyond the original definition to consider risk factors for severe exacerbations and frequency

of asthma exacerbations; however, specific criteria are not provided for classification. Further work to define screening instruments will be needed as these criteria are better defined. In addition, although we included only children who had 2 prior episodes of wheezing responsive to bronchodilators, we likely included younger children who may be transient wheezers with a different phenotype from children with chronic atopic asthma.<sup>25</sup>

Another issue related to screening is the time period over which parents are asked to categorize symptoms, particularly when symptoms are being assessed at the time of an acute exacerbation. The M-PACT asks parents to describe their child when at their best for the past 3 months, attempting to establish baseline symptoms rather than those attributable to an exacerbation. This method may provide a more conservative estimate of asthma control than other approaches; however, a more conservative assessment may be desirable for an instrument designed for a setting such as the ED. In addition, not all of the patients who screened positive for persistent asthma in the ED continued to report these symptoms at the time of the follow-up call. Many factors could account for this, including therapies initiated during the intervening period, changes in the patient's environment, and errors in classification at the time of the initial visit. Finally, this tool was designed to be completed by the parent with input by the child during the visit. Prior research in older children has found discrepancies between parental and child assessments of asthma control, with higher estimates of asthma symptoms reported by children.<sup>26</sup> Future work should explore other ways to explicitly include the child's assessment of symptoms. Future external validation of this screen is also warranted.

In summary, this study provides a simple set of questions that in conjunction with asthma history, can be used in the ED setting to assess asthma control. The M-PACT is a practical, brief tool that ED physicians can use as a first step to identify children with persistent asthma symptoms who may benefit from further long-term intervention in their asthma care.

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