Reasons for Pediatrician Nonadherence to Asthma Guidelines

Michael D. Cabana, MD, MPH; Cynthia S. Rand, PhD; Oren J. Becher, MD; Haya R. Rubin, MD, PhD

**Background:** The 1997 National Heart, Lung, and Blood Institute (NHLBI) asthma guidelines include recommendations on how to improve the quality of care for asthma.

**Objective:** To identify barriers to physician adherence to the NHLBI guidelines.

**Design:** Cross-sectional survey.

**Participants:** A national random sample of 829 primary care pediatricians.

**Main Outcome Measures:** Self-reported adherence to 4 components of the NHLBI guidelines (steroid prescription, instructing peak flow meter use, screening and counseling patients with asthma for smoking, and screening and counseling parents for smoking). We also collected information on physician demographics, practice characteristics, and possible barriers to adherence. We defined adherence as following a guideline component more than 90% of the time.

**Results:** The response rate was 55% (456/829). Most of the responding pediatricians were aware of the guidelines (88%) and reported having access to a copy of the guidelines (81%). Self-reported rates of adherence were between 39% and 53% for the guideline components. After controlling for demographics and other barriers, we found that nonadherence was associated with specific barriers for each guideline component: for corticosteroid prescription, lack of agreement (odds ratio [OR], 6.8; 95% confidence interval [CI], 3.2-14.4); for peak flow meter use, lack of self-efficacy (OR, 3.4; 95% CI, 1.9-6.1) and lack of outcome expectancy (OR, 4.7; 95% CI, 2.5-8.9); and for screening and counseling of patients and parents for smoking, lack of self-efficacy (OR, 3.8; 95% CI, 1.7-6.2 and OR, 2.8; 95% CI, 1.3-5.9, respectively).

**Conclusions:** Although pediatricians in this sample were aware of the NHLBI guidelines, a variety of barriers precluded their successful use. To improve NHLBI guideline adherence, tailored interventions that address the barriers characteristic of a given guideline component need to be implemented.

SUBJECTS AND METHODS

SUBJECTS

We randomly selected 1000 general pediatricians from the American Medical Association Masterfile of physicians in the United States, which includes all allopathic and most osteopathic physicians regardless of membership with the American Medical Association. We excluded pediatricians in training, pediatricians who spent greater than 30% of their professional time outside of clinical practice (ie, administration, research), and pediatric specialists. Between March and May 1999, we sent a cover letter, an 8-page questionnaire, and a prepaid return envelope to each subject. Nonrespondents received up to 3 reminder surveys. Physicians who did not respond after 3 attempts were contacted by telephone to confirm that they had received the survey. We did not offer an honorarium for participation. The study was approved by the institutional review board at the Johns Hopkins School of Medicine (Baltimore, Md).

SURVEY INSTRUMENT

The 1997 NHLBI asthma guidelines recommend that a patient with daily asthma symptoms should be prescribed a daily inhaled corticosteroid and should use a peak flow meter (PFM) to monitor daily symptoms. The guidelines also recommend that patients with asthma should not smoke or be exposed to tobacco smoke at home. We used the following questions to query respondents about adherence to these 4 guideline components:

1. For what percentage of patients with asthma with daily symptoms (≥8 years of age) do you instruct to monitor daily expiratory peak flow meter readings?
2. For what percentage of patients with asthma with daily symptoms do you prescribe a daily inhaled corticosteroid?
3. For what percentage of visits does someone in the practice screen patients with asthma for smoking and counsel smoking cessation?
4. For what percentage of visits does someone in the practice screen patients with asthma for smoking and counsel smoking cessation?

After pilot-testing the survey with a convenience sample of 10 general pediatricians, we selected the following response set for adherence that maximized discrimination among the responses and could be adapted to previously established definitions of adherence. For each of the components, pediatricians indicated adherence with 1 of 5 possible responses: “never” (0%), “just over half of the time (51%-75%)”, “most of the time (76%-90%)”, “almost all of the time (91%-99%)”, and “all of the time (100%).”

Based on a review of guideline adherence and focus groups with pediatricians, we asked about barriers to adherence to each of the 4 components: awareness of the guideline, familiarity with the specific guideline component, agreement with the component, confidence in the ability to

---

Table 1. Characteristics of Survey Recipients

<table>
<thead>
<tr>
<th></th>
<th>Respondents (n = 456)</th>
<th>Nonrespondents (n = 373)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, No. (%)</td>
<td>278 (61)</td>
<td>218 (58)</td>
</tr>
<tr>
<td>Median (SD) age, y</td>
<td>47.7 (10.4)</td>
<td>48.2 (10.8)</td>
</tr>
<tr>
<td>Board certified, No. (%)</td>
<td>416 (91)</td>
<td>304 (82)*</td>
</tr>
</tbody>
</table>

*P<.01.

GUIDELINE AWARENESS AND ACCESS

Eighty-eight percent of responding pediatricians were aware of the NHLBI guidelines. Eighty-one percent indicated that they had access to a copy of the guidelines; 13% were not sure. The remainder did not have access to a copy. Of the pediatricians who were aware, 77% reported that they were at least “adequately familiar” with the guidelines overall.

Respondents learned about the guidelines by reading a copy of the report (70%), attending continuing medical education (46%), and hearing information from pharmaceutical representatives (27%), other physicians (21%), or nonphysician colleagues (1%). Three percent listed other sources, including the National Institutes of Health, medical journals, residency training, managed care organizations, or insurance companies. Respondents learned about guidelines from 1 source (54%), 2 sources (25%), or 3 or more sources (21%). When multiple sources were cited, the most common combination was reading a copy of the guidelines and continuing medical education (66%). (Since respondents could indicate more than one answer, the totals are greater than 100%.)

We were concerned that respondents might give socially acceptable answers and overreport guideline familiarity. To test this possibility, we asked about items not present in the guidelines. When queried about recommendations for genetic testing for asthma, which are not present in the guidelines, only 5% of respondents in-
perform the guideline component (self-efficacy), belief that following the guideline component will affect patient outcomes (outcome expectancy), and the presence of practice barriers. We asked about specific practice barriers, such as lack of equipment or clinic space, lack of time during a patient visit, lack of educational materials, lack of support staff, and lack of reimbursement for services.

The questionnaire used a 5-point scale for respondents to indicate their level of familiarity (1, not at all familiar; 5, extremely familiar), agreement (1, strongly disagree; 5, strongly agree), and self-efficacy (1, not at all confident; 5, extremely confident). We used a 4-point scale for outcome expectancy (1, no effect; 4, large effect) and practice barriers (1, not at all significant; 4, extremely significant). We selected these different response sets from previous physician surveys that examined these constructs separately in relation to guideline adherence.\textsuperscript{14,10,17} Awareness was measured using a dichotomous response (yes/no). If pediatricians were not aware of the guideline, we assumed they were not familiar with the guideline components.

We asked about demographic data including year of completion of medical school and residency, practice setting, academic affiliation, number of patients with asthma, and board certification.

ANALYSIS

For each analysis of the 4 guideline components, our dependent variable of interest was a pediatrician’s self-reported adherence to the guidelines. We considered pediatricians adherent if they reported following a guideline component more than 90% of the time, based on previous definitions of adherence.\textsuperscript{14}

We dichotomized the responses. A factor was present if pediatricians answered 4 or 5 on a 5-point Likert-like scale or 3 or 4 on a 4-point scale. Self-efficacy for corticosteroid prescription was present if pediatricians indicated they were “very” or “extremely” confident in recognizing which patients may benefit from corticosteroid use, recognizing adverse effects, and discussing adverse effects. Since self-efficacy responses for screening for tobacco use and counseling for smoking cessation were not well correlated (weighted $k=0.41$ for patients with asthma, 0.42 for parents), we included separate independent variables for screening self-efficacy and counseling self-efficacy.

We used a $\chi^2$ analysis to compare each of the independent variables with self-reported adherence to the guideline component in question. We used multivariate logistic regression (SAS 6.12; SAS Institute; Cary, NC) to control for the presence of barriers, academic affiliation, and board certification. We hypothesized that pediatricians who see fewer patients with asthma might be less familiar with and less adherent to the guidelines and so we controlled for the number of patients with asthma ($\geq 100$ patients vs $<100$). We also hypothesized that pediatricians who completed training before 1990, when guidelines were less common, might be less likely to be adherent. We did not include sex in the final model since the univariate analysis showed no association with adherence.

Limited they were very or extremely familiar with such recommendations. In addition, the guidelines suggest that PFM$s$ are useful for monitoring, not diagnosing asthma. Only 1% of respondents strongly agreed that “peak flow meters can be used alone in the diagnosis of asthma.” These low percentages indirectly suggest validity in the responses and mitigate concerns about the overreporting of familiarity.

RATES OF ADHERENCE

Table 2 presents rates of self-reported adherence for the guideline components, stratified by sex and year of residency completion. Pediatricians reported similar rates for the prescription of corticosteroids (53%) and screening and counseling for smoking cessation (53%). The rate of screening and counseling for smoking cessation to parents (43%) was somewhat lower, and instruction of daily PFM use (39%) had the lowest rate of adherence.

BARRIERS TO ADHERENCE

Table 3 presents the prevalence of each barrier for each guideline component. The prevalence of lack of familiarity with each recommendation ranged from 23% to 34%. Since becoming familiar with a recommendation represents a more active process than passive awareness, lack of familiarity for all of the guideline components was more prevalent than lack of overall guideline awareness (12%).

In terms of external or practice-related barriers, approximately half of pediatricians reported lack of time for guideline components that involved intensive counseling and education, such as screening and counseling for smoking cessation to parents (50%) and patients (50%). Physicians reported lack of time less frequently for corticosteroid prescription (12%), which may require less counseling.

Different barriers were more prominent for different guideline components. For example, lack of agreement was more common for corticosteroid prescription, while lack of outcome expectancy was more common for the other guideline components.

ASSOCIATION OF BARRIERS WITH ADHERENCE

For each of the 4 guideline components, we examined the association between each barrier and pediatrician adherence. The unadjusted odds ratios (ORs) for all barriers were significantly greater than 1, which suggests that the presence of any of these factors increases the likelihood of nonadherence.

We hypothesized that some barriers might be more prominent for each guideline component. In addition, although a barrier might be prevalent, it might not necessarily be associated with physician nonadherence after controlling for the presence of other barriers. Table 4 presents the results of multivariate logistic regression analysis, which was used to control for the presence of
other barriers and demographic characteristics. Only lack of familiarity (OR, 1.64-2.51) and the presence of external barriers (OR, 1.65-1.90) are significantly associated with nonadherence to all 4 guideline components.

Each guideline component has a unique set of barriers associated with nonadherence. For example, nonadherence to corticosteroid prescription is associated with lack of agreement (OR, 6.79; 95% confidence interval [CI], 3.20-14.4) and academic affiliation (OR, 0.52; 95% CI, 0.33-0.82). Nonadherence to recommendations for PFM use is associated with lack of self-efficacy (OR, 3.36; 95% CI, 1.85-6.10) and lack of outcome expectancy (OR, 4.67; 95% CI, 2.46-8.86). Factors associated with nonadherence to smoking screening and counseling include lack of self-efficacy to inquire about smoking status (OR, 2.81; 95% CI, 1.34-5.89 and OR, 3.81; 95% CI, 1.70-6.19, respectively). For smoking screening and cessation counseling to patients, academic affiliation seems to be associated with increased adherence (OR, 1.63; 95% CI, 1.04-2.51).

We systematically examined barriers to pediatrician knowledge, attitudes, and self-reported adherence to the 1997 NHLBI asthma guidelines and found that each guideline component is associated with specific barriers to adherence. These findings have implications for selecting methods to improve adherence and quality of care for asthma. Self-reported adherence rates (defined as following recommendations for more than 90% of cases) range between only 38% and 53% for the 4 guideline components we queried.

Similar to Finkelstein et al,2 we found that most pediatricians are aware of the guidelines and have access to a copy of them. However, multiple factors are associated with poor guideline adherence. In addition, although a barrier may be prevalent (ie, lack of outcome expectancy for smoking cessation screening and counseling), it may not necessarily be associated with nonadherence after controlling for other barriers.

### Table 2. Self-reported Adherence to 4 Guideline Components*

<table>
<thead>
<tr>
<th>Guideline Component</th>
<th>Overall</th>
<th>Male</th>
<th>Female</th>
<th>Prior to 1990</th>
<th>After 1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescription of daily inhaled corticosteroids to patients with daily asthma symptoms (n = 446)</td>
<td>53</td>
<td>51</td>
<td>56</td>
<td>53</td>
<td>56</td>
</tr>
<tr>
<td>Instruction of daily peak flow meter use to patients with daily asthma symptoms (n = 447)</td>
<td>38</td>
<td>37</td>
<td>41</td>
<td>38</td>
<td>39</td>
</tr>
<tr>
<td>Screening asthma patients for smoking and counseling for smoking cessation (n = 449)</td>
<td>43</td>
<td>43</td>
<td>42</td>
<td>46</td>
<td>32</td>
</tr>
<tr>
<td>Screening the parents of patients with asthma for smoking and counseling for smoking cessation (n = 449)</td>
<td>53</td>
<td>51</td>
<td>55</td>
<td>52</td>
<td>53</td>
</tr>
</tbody>
</table>

*Data are given as percentage.

### Table 3. Percentage of Respondents Indicating Barriers to Adherence*

<table>
<thead>
<tr>
<th></th>
<th>Corticosteroid Prescription</th>
<th>PFM Use</th>
<th>Smoking Counseling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Parents</td>
</tr>
<tr>
<td>Lack of familiarity</td>
<td>25.1</td>
<td>26.8</td>
<td>34.0</td>
</tr>
<tr>
<td>Lack of agreement</td>
<td>17.5</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>Lack of self-efficacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To recognize indications for corticosteroids</td>
<td>5.5</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>To recognize adverse effects of corticosteroids</td>
<td>8.3</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>To discuss risks of corticosteroids with parents</td>
<td>7.2</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>To use PFM to guide therapy</td>
<td></td>
<td>8.9</td>
<td></td>
</tr>
<tr>
<td>To inquire about smoking status</td>
<td></td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>To counsel smoking cessation</td>
<td></td>
<td>15.1</td>
<td></td>
</tr>
<tr>
<td>Lack of outcome expectancy</td>
<td>2.5</td>
<td>27.4</td>
<td>60.9</td>
</tr>
<tr>
<td>Presence of external barriers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of equipment or space</td>
<td>4.4</td>
<td>15.3</td>
<td>11.7</td>
</tr>
<tr>
<td>Lack of time</td>
<td>12.0</td>
<td>27.9</td>
<td>49.7</td>
</tr>
<tr>
<td>Lack of educational materials</td>
<td>14.5</td>
<td>24.3</td>
<td>46.9</td>
</tr>
<tr>
<td>Lack of support staff</td>
<td>15.2</td>
<td>25.4</td>
<td>44.3</td>
</tr>
<tr>
<td>Lack of reimbursement</td>
<td>16.2</td>
<td>25.8</td>
<td>42.2</td>
</tr>
</tbody>
</table>

*Data are given as percentage. PFM indicates peak flow meter; lack of familiarity, respondents indicating that they were less than adequately familiar with the recommendation; lack of self-efficacy, respondents who were not at least moderately confident in their skills; ellipses, not applicable; lack of outcome expectancy, respondents who felt that recommendation would have little or no effect; and presence of external barriers, respondents who described barrier as moderately or extremely significant.
Although lack of awareness has been cited as a common barrier to adherence, in our study, pediatrician awareness of the NHLBI guidelines (84% aware) was high compared with other guidelines. A previous study cian awareness of the NHLBI guidelines (84% aware) was
tended time needed to counsel or educate a patient.

appropriate reimbursement might compensate for the ex-
tended time needed to counsel or educate a patient.

lack of reimbursement were similar reasons for nonad-
herence. Pediatricians might perceive these factors as re-
lated since educational materials and support staff are fac-
tors that might mitigate the barrier of lack of time, while
proper reimbursement might compensate for the ex-
tended time needed to counsel or educate a patient.

LIMITATIONS

There are several limitations to this study. Our survey
response rate was only 55% and respondents were more
likely to be board-certified in pediatrics. Both factors may
affect the generalizability of our results to practicing pe-
diatricians.

Adherence was based on self-report, which might not
reflect actual adherence. Studies of physician practice sug-
get that physician self-report can overestimate or under-
estimate actual practice when compared with chart au-
dits or patient surveys. However, our purpose was to
investigate if different recommendations are associated with
a different profile of barriers. The analysis assumes that
self-report bias will affect measures of barriers to adherence
as well as guideline adherence, thus preserving the
profile of barriers for each guideline component.

It is also encouraging that few respondents re-
ported familiarity with the spurious guideline compo-
nents that we included to test the validity of self-report.
Results from other studies suggest that physician self-
report is not wildly misleading. For example, Diette et
al surveyed 318 parents of children with asthma and found that 55% of patients with daily asthma symptoms
used a daily controller medication compared with 54%
in our study. Warman et al surveyed 220 parents of
children with asthma and found that only 30% of children
with persistent asthma had PFMs. In our sample, self-
reported adherence rate for instruction of PFM use was
similar at 38%. Finally, the presence of a barrier to ad-
herence is based on the respondents’ perception of the
barrier, which may not accurately reflect how problem-
atic a barrier is. Whether the problem is actual or per-
cipient may also affect the type of intervention required.

IMPLICATIONS

These results have implications for selecting interven-
tions to improve practice. Interventions should be tai-
lored to the guideline component being addressed. For
example, the factors associated with adherence to ster-
oid prescription and PFM use are different and inter-
ventions for each recommendation, although from the
same guideline, may take different forms.

Since lack of agreement is associated with steroid
prescription, interventions might theoretically include
physician participation in guideline development or
guideline endorsement by local opinion leaders or spe-
cialty societies. In several studies, physicians indi-
cated greater confidence in guidelines developed by their
own specialty organization. Increased awareness of the
endorsement of the NHLBI guidelines by pediatric
professional organizations might improve pediatrician
guideline agreement. Although the American Academy
of Pediatrics was represented during the guideline de-
velopment and publicly endorsed the guidelines, pedi-
diatricians may not be aware of these events.

Since low self-efficacy was associated with nonad-
herence to instructing PFM use, interventions might in-
clude practical workshops rather than traditional continu-
ing medical education lectures. Interactive seminars have
demonstrated improved physician communication and
management of asthma and use of metered-dose inhala-
ers and spacers. Feedback and audit to demonstrate that
PFMs actually affect outcomes of asthma treatment may
improve an individual’s outcome expectancy. Interven-
tions might also directly target sources of poor physician
outcome expectancy, such as poor patient asthma self-
management or compliance in general.

*PFM indicates peak flow meter; OR, odds ratio; CI, confidence interval; and ellipses, not applicable.
†P<.05.

Table 4. Logistic Regression Model of Pediatrician Nonadherence to 4 Guideline Components

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Corticosteroid Prescription, OR (95% CI)</th>
<th>Instructing PFM Use, OR (95% CI)</th>
<th>Screening and Counseling of Parents, OR (95% CI)</th>
<th>Screening and Counseling of Patients, OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of familiarity</td>
<td>2.29† (1.42-3.67)</td>
<td>2.51† (1.55-4.07)</td>
<td>2.02† (1.29-3.49)</td>
<td>1.64† (1.04-2.58)</td>
</tr>
<tr>
<td>Lack of agreement</td>
<td>6.79† (3.20-14.4)</td>
<td>6.46 (0.74-56.3)</td>
<td>1.22 (0.10-5.45)</td>
<td>2.77 (0.22-34.8)</td>
</tr>
<tr>
<td>Lack of self-efficacy</td>
<td>1.41 (0.88-2.25)</td>
<td>3.36† (1.85-6.10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of self-efficacy to inquire</td>
<td>. . .</td>
<td>. . .</td>
<td>2.81† (1.34-5.89)</td>
<td>3.81† (1.70-6.10)</td>
</tr>
<tr>
<td>Lack of self-efficacy to counsel</td>
<td>. . .</td>
<td>. . .</td>
<td>1.44 (0.89-2.32)</td>
<td>1.40 (0.89-2.30)</td>
</tr>
<tr>
<td>Lack of outcome expectancy</td>
<td>4.48 (0.46-43.3)</td>
<td>4.67† (2.46-8.86)</td>
<td>1.12 (0.72-1.75)</td>
<td>1.41 (0.88-2.27)</td>
</tr>
<tr>
<td>Presence of external barriers</td>
<td>1.65† (1.01-2.69)</td>
<td>1.90† (1.17-3.09)</td>
<td>1.78† (1.08-2.92)</td>
<td>1.71† (1.01-2.98)</td>
</tr>
<tr>
<td>Demographic/practice variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residency before 1990</td>
<td>1.23 (0.73-2.09)</td>
<td>1.14 (0.65-1.98)</td>
<td>1.30 (0.78-2.17)</td>
<td>0.72 (0.41-1.24)</td>
</tr>
<tr>
<td>Practice has &lt;100 asthma patients</td>
<td>1.21 (0.76-1.92)</td>
<td>0.93 (0.57-1.51)</td>
<td>1.09 (0.70-1.68)</td>
<td>1.44 (0.91-2.27)</td>
</tr>
<tr>
<td>No faculty affiliation</td>
<td>0.52† (0.33-0.82)</td>
<td>1.01 (0.63-1.62)</td>
<td>0.74 (0.49-1.41)</td>
<td>1.63† (1.04-2.51)</td>
</tr>
<tr>
<td>No pediatric board certification</td>
<td>0.85 (0.37-1.46)</td>
<td>0.58 (0.23-1.47)</td>
<td>1.04 (1.47-2.31)</td>
<td>0.34 (0.40-2.16)</td>
</tr>
</tbody>
</table>
The NHLBI guidelines offer recommendations to improve the care of asthma. Previous studies have shown that despite pediatrician awareness of the NHLBI asthma guidelines, there are additional barriers, such as lack of agreement, poor self-efficacy, or practice-related barriers, that prevent pediatrician adherence to these guidelines. This study documents that different components of the guidelines are associated with specific barriers to adherence. To improve pediatrician adherence to the NHLBI guidelines and asthma care, interventions should be tailored to these barriers.

In general, multiranked interventions are more successful than single interventions in changing practice. This study reinforces the need for multiple interventions for overall adherence and tailored interventions to address characteristic barriers of each guideline component.

In conclusion, although pediatricians in this sample seem to be well aware of the NHLBI asthma guidelines, there are many barriers to their use. Interventions to improve the rate of prescription of daily inhaled corticosteroids should attempt to foster pediatrician agreement. Efforts to improve the rate of PFM instruction to patients who have daily asthma should focus on teaching pediatricians how to use PFMs to guide asthma therapy and should show pediatricians how outcomes are affected by their patient’s use of PFMs. Finally, interventions to increase the use of smoking cessation counseling should attempt to improve pediatrician confidence to inquire about tobacco use among patients and parents.

Accepted for publication May 10, 2001.
This research was supported in part by the Robert Wood Johnson Foundation, Princeton, NJ.
We would like to thank Suchitra Chandrasekaran and Yezhisai Thirumavalavan for their help in organizing this study.
Corresponding author: Michael D. Cabana, MD, MPH, Division of General Pediatrics, University of Michigan School of Medicine, Room 6D09, North Ingalls Bldg, Box 0456, 300 N Ingalls St, Ann Arbor, MI 48109-0456 (e-mail: mcabana@med.umich.edu).

REFERENCES