Treatment compliance, passive smoking, and asthma control: a three year cohort study

D Soussan, R Liard, M Zureik, D Touron, Y Rogeaux, F Neukirch

Asthma is the most common chronic disease in childhood; it may affect up to 35% of the population in developed countries. Asthma is an inflammatory disease of the airways involving respiratory symptoms, such as wheezing and coughing, and reversible airflow limitation. Its severity differs widely between patients, but most people with asthma have a mild form of the disease.

International guidelines have been established for the management of asthma, based on a classification of asthma severity (before treatment) into four grades: intermittent, mild persistent, moderate persistent, and severe persistent. Inhaled anti-inflammatory medication is recommended for all patients with persistent asthma. The goal of management is to achieve control: symptoms, whether diurnal or nocturnal, should be absent or minimal with infrequent exacerbations, and pulmonary function should be normal. To achieve this, patients with persistent asthma should take anti-inflammatory medication as prescribed, even if they have no symptoms.

It should be possible to achieve control, whatever the initial severity stage, except in a few difficult/therapy resistant cases. However, in clinical practice, appropriate prescriptions do not result in asthma control in all patients; the reasons for this are not known. Identification of the personal or environmental characteristics of patients that are associated with the achievement of asthma control would be of great value for all doctors involved in asthma management. There is some epidemiological evidence of the role of compliance to treatment for adult patients: two studies showed that suboptimal use of inhaled steroids and overconfidence in β₂ agonists were associated with increased risk of acute asthma episodes and of hospital admission. In contrast, such studies for children are scarce. Milgrom et al recruited 24 children attending a specialist outpatient clinic and followed them for 13 weeks: they found that underuse of inhaled corticosteroids was related to more frequent need for oral steroid courses. The associations between passive smoking and asthma morbidity in children have been more extensively investigated, but with inconsistent results. Moreover, few of these studies have adjusted for potential confounding variables.

The objective of this cohort survey was to study the role of treatment compliance and of parents’ smoking on asthma control in children with recently diagnosed mild or moderate persistent asthma, prescribed inhaled anti-inflammatory treatment. Other family, personal, and environmental factors were taken into account.

PATIENTS AND METHODS
Chest specialists throughout France were asked by regional medical associations to participate in this three year prospective cohort survey and to include the first two children aged 6–12 years, examined between 1 March and 30 November 1995, that met the inclusion criteria. Inclusion criteria were: (1) documented asthma diagnosed during the inclusion visit or no more than 12 months previously (that is, recurrent episodes of wheezing or coughing with either a 15% increase in forced expiratory volume in one second (FEV₁) after bronchodilator use, or a 20% decrease in FEV₁ after bronchoconstrictor challenge); (2) FEV₁ ≥60% of the predicted value at the inclusion visit; and (3) informed consent obtained from the parents for participation in a three year study.

Criteria for exclusion were: (1) having a chronic respiratory disease other than asthma; (2) treatment with high doses of inhaled corticosteroids (>750 µg/day) for one month or longer at the time of inclusion; and (3) having unstable asthma (that is, asthma exacerbations during the past three months involving emergency care or systemic corticosteroids for 15 days or

Abbreviations: CI, confidence interval; FEV₁, forced expiratory volume in one second; OR, odds ratio; PEF, peak expiratory flow

Arch Dis Child 2003;88:229–233

Accepted 14 September 2002

Correspondence to: Dr D Soussan, INSERM U408 Epidémiologie, Faculté de Médecine Xavier Bichat, B.P. 416, 75870 Paris Cedex 18, France; dsoussan@bichat.inserm.fr

See end of article for authors’ affiliations
more). The exclusion criteria were aimed at excluding patients with severe or difficult asthma, which might have biased the results. At inclusion, each patient was given a new Mini-Wright peak flow meter (Clement Clarke, Harlow, UK), was instructed in its use, and told to record the highest peak expiratory flow (PEF) of three measurements for each timepoint.

During the three year follow up period, patients were examined every four months. They measured PEF on getting up (before inhaling β agonists) and in the evening, for a week before each visit, and recorded the measurements in a diary.

Data were collected by means of detailed standardised questionnaires completed by physicians. The initial questionnaire included questions concerning the patient's socio-demographic background, personal history of allergy (seasonal or perennial rhinitis, atopic dermatitis), and family history of asthma, lifestyle, and environmental factors (exposure to tobacco smoke, moulds, or animals; type of bedding and flooring; cooking appliances). The physicians also reported the results of atopy tests (skin prick tests or specific IgE) and lung function tests, carried out according to usual clinic practice, and the medication prescribed for asthma. Most questions were derived from the ECRHS questionnaire. The follow up questionnaires completed at each visit included questions concerning changes in lifestyle and environment, possible severely negative life events, and the medication prescribed. Questions focusing on environmental tobacco smoke assessed whether at least one person smoked in the home, and if yes, if it was the father, the mother, brothers or sisters, or another person. Standardised questions focusing on treatment compliance assessed: (1) whether the patient understood how each drug worked; (2) whether the patient ever forgot to take the drugs; (3) whether the patient took the prescribed doses without either decreasing or increasing them; and (4) the doctor's opinion concerning whether the patient's technique for taking inhaled medication was adequate.

In both the initial and follow up questionnaires, asthma symptoms were assessed using questions developed from the international guidelines, concerning the frequency of asthma attacks (diurnal and nocturnal) and the occurrence of wheezing or coughing between the attacks. The same questions were asked at each visit.

The protocol was approved by local ethics authorities and by the National Committee for Data Processing and Freedom. Two hundred and fifty one chest specialists participated in the study; they included a total of 334 children, as many specialists did not have two patients that met the inclusion criteria for the protocol (especially for recent diagnosis).

Statistical analysis
Because international guidelines suggest that optimal treatment is achieved several months after diagnosis, we took the third follow up visit (one year after inclusion) as the starting point for assessing control. The 201 children that were on anti-inflammatory medication at that time were considered to have persistent asthma and were eligible for this study. Eighty three of these patients attended all six visits scheduled for the second and third years of follow up, 46 attended five, 21 attended four, 17 attended three, and 34 attended less than three. We analysed only the 167 (83%) children that had attended at least three visits (mean 5.2). These children did not differ from the other 34 eligible children in age, sex, symptom severity, sensitisation to allergens, allergic rhinitis, dermatitis, or family history of asthma.

We used two independent control criteria:

- “Symptom control” was satisfactory if the child had diurnal and nocturnal asthma less than once a week and had no symptoms between attacks, at all visits in the second and third years.
- “PEF control” was satisfactory if daily PEF variability was <20% each of the seven days before each visit. Daily PEF variability was calculated as (maximum PEF − minimum PEF)/mean PEF, %.

For personal characteristics we analysed the data collected at inclusion. Lifestyle and environmental factors were considered to be present if they were reported at inclusion and at any time during follow up (there were very few changes after inclusion). Each of the four variables indicating compliance was considered to be positive if compliance was achieved at all visits in the second and third years.

We used the SAS-PC statistical package (SAS Institute Inc, Cary, NC, USA). In a preliminary univariate analysis, contingency tables were analysed using the χ² test, and two tailed Fisher's exact test if numbers were small, to select the factors to be considered for the final multivariate analysis. In multiple logistic regression analyses with symptom control or PEF control as dependent variables, we included the factors that were associated in the univariate tests with p values <0.20. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for the association between outcome and the explanatory factors.

RESULTS
Table 1 presents the characteristics of the 167 children studied and the factors considered in the analysis. Mean age was 9.5 years (SD 2.0). Most patients (93%) were atopic and sensitisation to more than one allergen was very frequent: 17.1% of the

### Table 1
Characteristics of the study population

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt;10 years</td>
<td>35.3</td>
</tr>
<tr>
<td>Boys</td>
<td>64.1</td>
</tr>
<tr>
<td>Father’s occupation</td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>8.9</td>
</tr>
<tr>
<td>Clerk</td>
<td>53.7</td>
</tr>
<tr>
<td>Manual labourer</td>
<td>20.3</td>
</tr>
<tr>
<td>Other</td>
<td>17.1</td>
</tr>
<tr>
<td>Atopic</td>
<td>93.1</td>
</tr>
<tr>
<td>Sensitised to mites</td>
<td>79.3</td>
</tr>
<tr>
<td>Sensitised to cats or dogs</td>
<td>33.3</td>
</tr>
<tr>
<td>Sensitised to pollen</td>
<td>54.1</td>
</tr>
<tr>
<td>Sensitised to moulds</td>
<td>20.8</td>
</tr>
<tr>
<td>Perennial asthma</td>
<td></td>
</tr>
<tr>
<td>(with or without seasonal exacerbations)</td>
<td>59.9</td>
</tr>
<tr>
<td>Perennial allergic rhinitis (with or without perennial AR)</td>
<td>51.2</td>
</tr>
<tr>
<td>Seasonal allergic rhinitis (with or without perennial AR)</td>
<td>19.3</td>
</tr>
<tr>
<td>Atopic dermatitis</td>
<td>34.3</td>
</tr>
<tr>
<td>Family history of asthma</td>
<td></td>
</tr>
<tr>
<td>Father</td>
<td>19.6</td>
</tr>
<tr>
<td>Mother</td>
<td>24.7</td>
</tr>
<tr>
<td>Siblings</td>
<td>17.7</td>
</tr>
<tr>
<td>Gas used for cooking</td>
<td>89.0</td>
</tr>
<tr>
<td>Moulds on walls within the home</td>
<td>16.3</td>
</tr>
<tr>
<td>Dog within the home</td>
<td>34.1</td>
</tr>
<tr>
<td>Cat within the home</td>
<td>17.1</td>
</tr>
<tr>
<td>Wall to wall carpets</td>
<td>58.4</td>
</tr>
<tr>
<td>Woollen mattress</td>
<td>13.1</td>
</tr>
<tr>
<td>Allergy proof mattress cover</td>
<td>6.0</td>
</tr>
<tr>
<td>Passive smoking</td>
<td></td>
</tr>
<tr>
<td>At least one smoker within the home</td>
<td>35.8</td>
</tr>
<tr>
<td>Mother smoking within the home</td>
<td>21.2</td>
</tr>
<tr>
<td>Compliance</td>
<td></td>
</tr>
<tr>
<td>Understands how medication works</td>
<td>67.1</td>
</tr>
<tr>
<td>Does not forget to take the drugs</td>
<td>34.1</td>
</tr>
<tr>
<td>Takes the prescribed doses</td>
<td>52.1</td>
</tr>
<tr>
<td>Adequate technique for use of inhalers</td>
<td>48.5</td>
</tr>
</tbody>
</table>

AR, allergic rhinitis.
atopic patients were sensitised to two allergens, and 75.3% to three or more. Asthma was diagnosed at the inclusion visit for 14 children (8.4%). Mean time from diagnosis to inclusion was 5.2 months (SD 4.0). The anti-inflammatory medication prescribed at the starting point for assessing control was corticosteroids >500 µg for 26.9% of children, corticosteroids <500 µg for 25.8%, and nedocromil or cromoglycate for 47.3%. Thirteen per cent of patients also had prescriptions for long acting β2 agonists.

Symptom control was achieved by 25.1% of children and PEF control by 53.3%. There was a significant positive association between the two outcomes: 30 patients were positive for both, 59 for PEF control only, 12 for symptom control only, and 66 patients achieved neither (p = 0.006).

Table 2 shows the factors that were associated with either symptom control or PEF control in univariate analysis.

### Table 2  Factors associated with symptom control or PEF control in univariate analysis

<table>
<thead>
<tr>
<th></th>
<th>Symptom control (%)</th>
<th>PEF control (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No (n=125)</td>
<td>Yes (n=42)</td>
</tr>
<tr>
<td>Age &gt;10 years</td>
<td>35.2</td>
<td>37.5</td>
</tr>
<tr>
<td>Boys</td>
<td>68.8</td>
<td>50.0</td>
</tr>
<tr>
<td>Sensitised to mites</td>
<td>81.2</td>
<td>73.8</td>
</tr>
<tr>
<td>Sensitised to pollens</td>
<td>54.7</td>
<td>52.4</td>
</tr>
<tr>
<td>Perennial asthma</td>
<td>60.0</td>
<td>59.5</td>
</tr>
<tr>
<td>Perennial allergic rhinitis</td>
<td>54.8</td>
<td>40.5</td>
</tr>
<tr>
<td>Seasonal allergic rhinitis</td>
<td>21.7</td>
<td>11.9</td>
</tr>
<tr>
<td>Atopic dermatitis</td>
<td>35.5</td>
<td>30.9</td>
</tr>
<tr>
<td>Family history of asthma: father</td>
<td>22.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Gas cooker</td>
<td>86.9</td>
<td>95.1</td>
</tr>
<tr>
<td>Moulds within the home</td>
<td>16.9</td>
<td>14.3</td>
</tr>
<tr>
<td>Wall to wall carpets</td>
<td>62.1</td>
<td>47.6</td>
</tr>
<tr>
<td>Passive smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At least one smoker within the home</td>
<td>40.6</td>
<td>21.4</td>
</tr>
<tr>
<td>Mother smoking within the home</td>
<td>23.6</td>
<td>14.3</td>
</tr>
<tr>
<td>Compliance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understands how medication works</td>
<td>60.8</td>
<td>85.7</td>
</tr>
<tr>
<td>Takes the prescribed doses</td>
<td>45.6</td>
<td>71.4</td>
</tr>
<tr>
<td>Adequate technique for inhaler use</td>
<td>44.0</td>
<td>61.9</td>
</tr>
</tbody>
</table>

Table 3 shows the factors that were associated with either symptom control or PEF control with p values <0.20, in univariate analyses. Symptom control was positively associated with three variables expressing treatment compliance and inversely with the presence of at least a smoker in the home and with male sex. PEF control was positively associated with taking the prescribed doses and inversely with mother’s smoking within the home, as well as with perennial asthma, atopic dermatitis, and moulds within the home. Seven children experienced a negative life event (parental separation for three, and death of a relative for four): no association was found between such events and asthma control.

In multiple logistic regression analysis, symptom control (table 3) was positively associated with having understood the way in which the medication worked and taking the prescribed doses (OR = 3.38, p = 0.03; and OR = 4.82, p = 0.002, respectively). It was inversely related to smoking within the home (OR = 0.34, p = 0.03). PEF control (table 4) was positively related to taking the prescribed doses (OR = 3.58, p = 0.001). It was less frequently achieved if the mother smoked (OR = 0.34, p = 0.03), but also if there were moulds within the home (OR = 0.33, p = 0.05).

Multiple logistic regression analyses restricted to the subgroup of 83 children that attended all six follow up visits confirmed the results reported above.

Finally, we compared the 32 children who achieved both symptom and PEF control with the 66 who achieved neither: the OR for understanding the way in which the medication worked was 5.31 (95% CI: 1.17 to 24.13), and the OR for taking the prescribed doses was 16.82 (95% CI: 4.11 to 68.94).
The efficacy of treatment.

smoke. Interestingly, it should be possible to manipulate the
treatment compliance (having understood the way in which
specialists, showed that the control of asthma symptoms and
of daily PEF variability was positively associated with
treatment compliance (having understood the way in which
each drug worked and taking the prescribed doses). Control
was less frequently achieved in children exposed to tobacco
smoke. Interestingly, it should be possible to manipulate the
factors found to be associated with asthma control, to increase
the efficacy of treatment.

The strength of this epidemiological study is to have
followed up a large number of children with routinely treated
persistent asthma, in the years following diagnosis. Moreover,
the children were not recruited in a particular clinic or hospi-
tal, but were treated by a large number of doctors throughout
France, which makes the results more generalisable. However,
some limitations might be related to the recruitment of
doctors or patients. The chest specialists that collected the data
were asked by regional medical associations to participate in
the study. This may introduce selection bias, which could have
been avoided by selecting doctors randomly from a sampling
frame of chest specialists. However, the level of participation
in studies of this type is generally low. For example, for a study
of the misuse of pressurised metered dose inhalers, we randomly
selected a sample of general practitioners and chest specialists
from the French medical profession directory. The participa-
tion rate among specialists was less than 40%. Doctors inter-
ested in participating in epidemiological studies may treat
their patients differently and may explain how the drugs work
in more detail, but this is unlikely to bias associations between
prognostic factors and disease outcome. The selection of
patients by doctors would have been more problematic, but is
very unlikely to have occurred as many doctors did not even
reach the required number of eligible patients, because for
most of their patients asthma had been diagnosed more than
12 months before the inclusion period. Although 334 patients
were recruited according to the protocol, for this analysis of
the role of treatment compliance we considered as eligible
only the 201 children that were prescribed anti-inflammatory
medication. Patients’ participation was very good, since 167
(83%) of them attended at least three visits out of six in the
second and third year of follow up (mean 5.2). The absence
of association between asthma control and the category of anti-
inflammatory medication prescribed suggests that the treat-
ment was adequate despite 47.3% of the children being
prescribed cromolyn instead of corticosteroids. The use of cro-
omlyn as a first line therapy, particularly in those with milder
disease, is encouraged by the results of a recently published
study of a large cohort of children. The proportion of children that achieved asthma control
was low for both outcomes. This can be explained by the defi-
nitions of control used in the analysis, which are conservative
and would probably be considered as too stringent by many
chest physicians in current practice. However, any definition
would be arbitrary. We defined asthma control in terms of the
clinical features described for intermittent asthma (step 1) in
the international guidelines, given that in controlled asthma,
symptoms should be absent or minimal and pulmonary func-
tion should be normal. For lung function, we used daily PEF
variability rather than PEF values. A marked increase in diur-
nal variability is a feature of poorly controlled asthma, whereas a decrease in PEF values is associated with asthma
exacerbation. The two types of control that we studied were
positively associated but did not actually coincide, and twice
as many children achieved PEF control as achieved symptom
control. Previous studies have shown that changes in PEF
variability during maintenance treatment with anti-
inflammatory drugs are correlated to various extents with
other indices of disease activity.

A major finding of this study is the demonstration of an
association between treatment compliance and asthma control.
Although expected, such an association has never
before been documented in children outside clinical trials.
Compliance with drugs is difficult to measure in epidemiologi-
cal studies, especially if the questions are asked by the doctor
who prescribed the treatment: the patients’ desire to “please”
their clinicians may result in an overestimate of self reported
compliance with the prescribed treatment. Various methods
can be used to assess compliance with asthma therapies. Self report of compliance is not a reliable measure of
“objective” compliance as measured by actual canister or puff
counts. However, the methods considered to be the most reli-
able could not be used in this observational study setting.
Moreover, even with “objective” methods it is difficult to dis-
tinguish between actual use of the drug and drug “dumping”
(the disposal of medication before a scheduled appointment). Compliance level depends on the population
studied, but also on the definitions used: it is therefore
difficult to compare the results of different studies. The
compliance rates observed in this study seem reasonable, tak-
ing into account that participation in a clinical study may
increase the patients’ motivation and compliance. Even if
the definitions of compliance used in this study were
debatable, they would have biased the results only if those
with poorer control had reported poorer compliance, which is
unlikely. Anyway, only such an observational study design is
feasible to assess the effect of real world medication
compliance on asthma control. Our data do not enable us to
quantify the percentage of medication taken as prescribed, by

Table 4 Odds ratios and 95% confidence intervals for the association between PEF control and possible explanatory factors (multiple logistic regression)

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 10 years</td>
<td>2.03</td>
<td>0.93 to 4.44</td>
<td>0.08</td>
</tr>
<tr>
<td>Sensitisation to mites</td>
<td>0.62</td>
<td>0.24 to 1.62</td>
<td>0.33</td>
</tr>
<tr>
<td>Sensitisation to pollens</td>
<td>0.48</td>
<td>0.23 to 1.03</td>
<td>0.06</td>
</tr>
<tr>
<td>Perennial asthma</td>
<td>0.69</td>
<td>0.31 to 1.53</td>
<td>0.36</td>
</tr>
<tr>
<td>Atopic dermatitis</td>
<td>0.51</td>
<td>0.23 to 1.15</td>
<td>0.11</td>
</tr>
<tr>
<td>Moulds within the home</td>
<td>0.33</td>
<td>0.11 to 0.97</td>
<td>0.05</td>
</tr>
<tr>
<td>Passive smoking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother smoking within the home</td>
<td>0.34</td>
<td>0.14 to 0.89</td>
<td>0.03</td>
</tr>
<tr>
<td>Compliance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understands how medication works</td>
<td>1.49</td>
<td>0.68 to 3.29</td>
<td>0.32</td>
</tr>
<tr>
<td>Takes the prescribed doses</td>
<td>3.58</td>
<td>1.68 to 7.67</td>
<td>0.001</td>
</tr>
</tbody>
</table>

DISCUSSION

This three year study of a cohort of children recently
diagnosed with mild or moderate persistent asthma and
treated with inhaled anti-inflammatory drugs by chest
specialists, showed that the control of asthma symptoms and
of daily PEF variability was positively associated with
treatment compliance (having understood the way in which
each drug worked and taking the prescribed doses). Control
was less frequently achieved in children exposed to tobacco
smoke. Interestingly, it should be possible to manipulate the
factors found to be associated with asthma control, to increase
the efficacy of treatment.

The strength of this epidemiological study is to have
followed up a large number of children with routinely treated
persistent asthma, in the years following diagnosis. Moreover,
the children were not recruited in a particular clinic or hospi-
tal, but were treated by a large number of doctors throughout
France, which makes the results more generalisable. However,
some limitations might be related to the recruitment of
doctors or patients. The chest specialists that collected the data
were asked by regional medical associations to participate in
the study. This may introduce selection bias, which could have
been avoided by selecting doctors randomly from a sampling
frame of chest specialists. However, the level of participation
in studies of this type is generally low. For example, for a study
of the misuse of pressurised metered dose inhalers, we randomly
selected a sample of general practitioners and chest specialists
from the French medical profession directory. The participa-
tion rate among specialists was less than 40%. Doctors inter-
ested in participating in epidemiological studies may treat
their patients differently and may explain how the drugs work
in more detail, but this is unlikely to bias associations between
prognostic factors and disease outcome. The selection of
patients by doctors would have been more problematic, but is
very unlikely to have occurred as many doctors did not even
reach the required number of eligible patients, because for
most of their patients asthma had been diagnosed more than
12 months before the inclusion period. Although 334 patients
were recruited according to the protocol, for this analysis of
the role of treatment compliance we considered as eligible
only the 201 children that were prescribed anti-inflammatory
medication. Patients’ participation was very good, since 167
(83%) of them attended at least three visits out of six in the
second and third year of follow up (mean 5.2). The absence
of association between asthma control and the category of anti-
inflammatory medication prescribed suggests that the treat-
ment was adequate despite 47.3% of the children being
prescribed cromolyn instead of corticosteroids. The use of cro-
omlyn as a first line therapy, particularly in those with milder
disease, is encouraged by the results of a recently published
study of a large cohort of children.
“compliers”. However, for “compliers”, self reported compliance was very good because it was considered to be positive only if it was achieved at all visits in the second and third years.

Our study also showed a negative effect on children’s asthma control of adults smoking within the home (particularly mothers for PEF control). Our results are the opposite of those of the recent study by Crombie et al, where parental smoking in the home was associated with a reduction in health care contacts for asthma. This discrepancy is probably explained by the difference in the outcomes considered. In the Crombie et al study the outcomes were likely to be related to parents’ attitudes, in that smoking parents might not give adequate management to children’s asthma. In our study asthma outcomes were more objective.

In our study, compliance to treatment and exposure to tobacco smoke were each independently associated with asthma control in multiple logistic regression analyses which also included other possible predictors. The confounding factors investigated in this study were those that have been described as risk factors of the progression of asthma through childhood. However, we were unable to explore fully the possible effects of severely negative life events because there were very few such events.

As children with severe or unstable asthma were not recruited (according to the protocol) and we analysed the data for those who were prescribed inhaled anti-inflammatory drugs, our results are relevant to patients with mild or moderate persistent asthma, who account for a large proportion of asthmatic children. Although our study was carried out in chest specialists’ practices, our findings are probably also applicable to general practices.

We conclude that further efforts should be made to maximise the benefit derived from available asthma medication and to improve health outcomes. Parents of asthmatic children should be persuaded not to smoke in the home, and compliance should be improved by ensuring that parents understand the disease and its treatment and by convincing them that it is essential to take medication exactly as prescribed.

ACKNOWLEDGEMENTS

The study was supported by Aventis France. It was implemented thanks to the “Association pour les études en pneumologie libérale” (AEPF), and particularly Drs Thierry Lepage (Association des pneumologues de l’Ile de France, APPI), Jean Martinat (Société alpine des pneumologues libéraux, SAPL), and Yves Rogeaux (Association des pneumologues de la Région Nord, APRN). We would like to thank all the chest specialists who enrolled patients in the study, and the patients who kindly agreed to participate in this research. Particular thanks are extended to François-Xavier Beguin, who initiated this study.

Authors’ affiliations

D Soussan, R Liard, M Zureik, F Neukirch, INSERM Unit 408, Paris, France
D Tauron, Laboratoire Aventis, Paris, France
Y Rogeaux, Association pour les Études en Pneumologie Libérale (AEPF) and Association des Pneumologues de la Région Nord (APRN), France

REFERENCES