

## Review of prescribed treatment for children with asthma in 1990

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### Abstract

**Objective**—To review treatment prescribed to asthmatic children in Great Britain during the 12 months after publication of the first guidelines and to assess effectiveness of prophylactic treatment.

**Design**—Review of prescribing information from January 1990 to June 1991 in a representative sample of general practices in Great Britain with a Compufile/AAH Meditel computer.

**Subjects**—17 846 children with asthma aged 4-17 years.

**Main outcome measures**—Numbers of children prescribed different asthma treatments; estimated use of inhaled  $\beta$  agonists in those receiving prophylactic treatment.

**Results**—From January to December 1990, 9362 (52.5%) children were prescribed preventive treatments. 16211 (90.8%) children were prescribed bronchodilators of some kind. 3055 (17.1%) were prescribed sodium cromoglycate, and the proportion decreased significantly during the study (from 19.5% (95% confidence interval 18.6% to 20.4%) to 17.2% (16.4% to 18.1%),  $P < 0.001$ , in children aged 4-11 years and from 14.9% (14.0% to 15.9%) to 11.3% (10.4% to 12.2%),  $P < 0.001$ , in those aged 12-17 during January-July 1991). 6952 (39.0%) were prescribed inhaled steroids, and the proportion increased during the study (from 35.1% (34.0% to 36.2%) to 44.1% (43.0% to 45.2%),  $P < 0.001$ , in children aged 4-11 years and from 38.7% (37.4% to 40.0%) to 44.1% (42.7% to 45.5%),  $P < 0.001$ , in those aged 12-17 during January-July 1991). Only 1358 of the 9362 children (14.5%) received sufficient repeat prescriptions to suggest that they might be taking the prophylactic treatment regularly. Among these children short acting inhaled  $\beta$  agonists were being used on average four to eight times a day.

**Conclusions**—These results are useful baseline data for audit of the impact of published clinical guidelines, particularly in terms of reducing the need for short acting inhaled  $\beta$  agonists with prophylactic treatment.

### Introduction

In 1989 guidelines for the management of childhood asthma were published by an international paediatric asthma consensus group.<sup>1</sup> These guidelines were subsequently used in many countries around the world as a basis for management protocols, and they were widely publicised and distributed in general practices in Great Britain. As a result of the experience gained in their application, the guidelines were revised in a follow up consensus statement in 1992.<sup>2</sup> The aims of management and the outline of the protocol remained the same. The main goals were to enable children to participate in normal activities including sport; to avoid excessive absence from school; to be free of symptoms during the day and night; to have normal lung function with no excess diurnal variation; and to

have no exacerbations. It was also hoped that treatment would achieve control with no side effects. Later the British Thoracic Society's guidelines included recommendations for children that were consistent with the international paediatric consensus statement<sup>3</sup> and the National Heart Lung and Blood Institute's international statement.<sup>4</sup>

All the guidelines firmly recommend that preventive treatment should be introduced early in the disease to reduce the need for relieving doses of  $\beta$  agonists. The upper limit of bronchodilator use before the introduction of or increase in dose of prophylactic treatment was set at two to three times a week in the paediatric guidelines<sup>1,2</sup> and no more than once a day in the British Thoracic Society's guidelines.<sup>3</sup>

When the guidelines were being formulated, there was no clear idea of prescribing practices, and, to my knowledge, the recommendations have not yet been subject to audit. Indices of asthma morbidity in relation to hospital admissions and death rates show no evidence of improvement, despite the belief that following the strategy should achieve the aims in most patients.<sup>1,4</sup> I therefore reviewed prescribed treatment for children with asthma in Great Britain over the 12 months immediately after publication of the first paediatric guidelines.<sup>1</sup> I assessed the effectiveness of control of asthma by examining the use of bronchodilators in children who received regular prophylactic treatment.

### Patients and methods

Prescribing information was gathered from 398 of the 800 general practices throughout Great Britain that used a Compufile/AAH Meditel practice computer in 1990. The 398 study practices were selected by a two stage process. Firstly, each practice's monthly prescriptions were plotted out and those in which the number of patients reported on was increasing noticeably were discarded. This eliminated any practices who were still entering patient data, as it took an average of nine months to achieve full computerisation of medical records. Secondly, the number of prescriptions issued each month by practice size was examined. Practices that were apparently issuing too few prescriptions per general practitioner, suggesting inadequate entry of data, were discarded. The demographic data of those remaining were reasonably representative of Great Britain as a whole (table I).<sup>5,7</sup> There was, however, an overrepresentation of smaller practices and an underrepresentation of Scottish general practitioners. The data reviewed were generated by about 1000 general practitioners and included repeat prescriptions issued by any members of the practice staff. I analysed the prescribing data for January-December 1990. Information covering the six months from January to June 1991 is more limited, but I have included it when appropriate. As the computer system is used by practices for recording and managing data on patients the information is likely to be accurate.

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TABLE 1—Distribution of general practices and practitioners by region and number of partners in study sample and nationally. Values are numbers (percentages)

	General practices in study sample (n=398)	General practitioners nationally (n=31 089) <sup>a</sup>
England:		
Regional health authority:		
Northern	40 (10)	1675 (5)
Yorkshire	32 (8)	1988 (6)
Trent	44 (11)	2473 (8)
East Anglian	20 (5)	1142 (4)
North West Thames	24 (6)	1974 (6)
North East Thames	16 (4)	2041 (7)
South East Thames	12 (3)	1996 (6)
South West Thames	13 (3)	1580 (5)
Wessex	36 (9)	1644 (5)
Oxford	25 (6)	1380 (4)
South Western	36 (9)	2030 (7)
West Midlands	33 (8)	2747 (9)
Mersey	15 (4)	1247 (4)
North Western	28 (7)	2051 (7)
Wales	16 (4)	1676 (5)
Scotland	8 (2)	3445 (11)
No of partners:		
1*	68 (17)	3220 (10)
2	77 (19)	4340 (14)
3	72 (18)	5355 (17)
4	5 (1)	5804 (19)
5	12 (3)	12 370 (40)

\*Single handed practice.

The database contained records on 111 516 children aged 4-11 years and 75 171 children aged 12-17 years. Of these children, 10 668 (9.6%) aged 4-11 and 7178 (9.6%) aged 12-17 were prescribed treatment for asthma by their general practitioner at least once during January-December 1990. I analysed data on children aged 4 years and over who were prescribed asthma treatment because they almost certainly had asthma; younger children could have had other conditions. Furthermore, above 4 years of age children might be expected to be able to use one of the standard inhaler devices. I considered the children in the groups according to age (4-11 and 12-17 years) because guidelines suggested different management strategies, particularly in relation to inhalation devices and doses of drugs, in these two age groups.<sup>1</sup>

From the number of repeat prescriptions I estimated the frequency of usage of bronchodilators and, to some

extent, compliance with prophylaxis. I considered the use of short acting  $\beta$  agonists, particularly salbutamol, the most frequently prescribed drug in this category, in groups of children based on age and prescription of prophylactic treatment. I determined the numbers of inhalers prescribed during the 12 months by calculating the intake of inhaled salbutamol and assuming that each inhaler contained 200 doses. In fact, each inhaler contains more than 200 doses, but as some would have been used for test firing I considered that 200 was a reasonable estimate of the number used by a patient. I also assumed that each salbutamol inhaler prescribed was used completely when I calculated the assumed number of doses taken. I used similar calculations to establish whether a child was likely to have taken the preventive treatments regularly.

I examined the use of bronchodilators in the children who were prescribed regular inhaled preventive treatment. This subgroup was defined as those who were prescribed six or more corticosteroid inhalers or nine or more sodium cromoglycate inhalers during the 12 months from January to December 1990. The fact that these children were returning to their doctor for repeat prescriptions implies that they were taking treatment regularly.

#### STATISTICAL ANALYSES

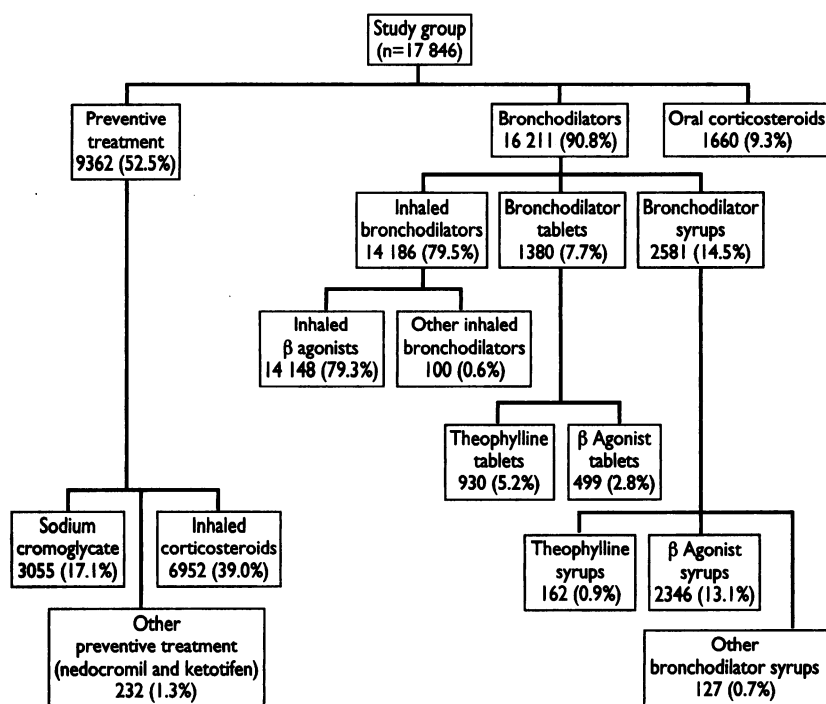
I considered all relevant data that were available on the database. They were analysed with SAS version 6.04 on MSDOS. The results are given with 95% confidence intervals when appropriate. I used the  $\chi^2$  test to compare the proportions of patients receiving the treatments during the first six months of 1990 and 1991.

Tests for normality showed that the data were skewed, so Wilcoxon rank sum tests were used to compare treatment with no inhaled corticosteroid, beclomethasone dipropionate, or sodium cromoglycate. Significance levels were two sided.

#### Results

The figure shows the range of treatments prescribed to asthmatic children aged 4-17 who received at least one prescription for asthma treatment during 1990. Overall, 52.5% (9362) of children were prescribed some form of preventive treatment; 90.8% (16 211) received bronchodilators and 9.3% (1660) oral steroids. Sodium cromoglycate was prescribed to 17.1% (3055) and inhaled steroids to 39.0% (6952). Other preventive treatments such as nedocromil and ketotifen were prescribed to only 1.3% (232) of children. Most children took their bronchodilator in the form of short acting inhaled  $\beta$  agonist (79.3%; 14 148), although some were prescribed bronchodilator syrups (14.5%; 2581) or tablets (7.7%; 1380). Theophyllines constituted most of the bronchodilator tablets prescribed, but  $\beta$  agonists accounted for most of the syrups prescribed (figure). Over three periods of six months—January-June 1990, July-December 1990, and January-June 1991—the proportion receiving inhaled steroids rose significantly ( $P < 0.001$ ) and the proportion receiving sodium cromoglycate fell significantly ( $P < 0.001$ ) in both the age groups (table II). Significantly more of the younger children were prescribed sodium cromoglycate ( $P < 0.001$ ), but they also had the greatest increase in prescriptions for inhaled steroids over the 18 month period. Indeed from January to June 1991 more younger than older children were prescribed preventive treatment (table II) ( $P < 0.001$ ).

Only 14.5% of those receiving any prescription for a preventive treatment in the 12 months (1358/9362) had sufficient repeat prescriptions to suggest that they were



Numbers (percentages) of children aged 4-17 receiving at least one prescription for asthma treatment from January to December 1990

TABLE II—Proportions (with 95% confidence intervals) of children prescribed preventive treatments for asthma

Age group (years)	Jan-June 1990 (n=7310 aged 4-11; n=5222 aged 12-17)	July-Dec 1990 (n=8018 aged 4-11; n=5418 aged 12-17)	Jan-June 1991 (n=7550 aged 4-11) n=4964 aged 12-17)	P values*
Preventive treatment:				
4-11	52.1 (51.0 to 53.2)	55.2 (54.1 to 56.3)	58.4 (57.3 to 59.5)	<0.001
12-17	51.1 (49.7 to 52.5)	52.8 (51.5 to 54.1)	53.6 (52.2 to 55.0)	<0.012
Inhaled corticosteroids:				
4-11	35.1 (34.0 to 36.2)	39.7 (38.6 to 40.8)	44.1 (43.0 to 45.2)	<0.001
12-17	38.7 (37.4 to 40.0)	42.8 (41.5 to 44.1)	44.1 (42.7 to 45.5)	<0.001
Sodium cromoglycate:				
4-11	19.5 (18.6 to 20.4)	18.3 (17.5 to 19.2)	17.2 (16.4 to 18.1)	<0.001
12-17	14.9 (14.0 to 15.9)	12.6 (11.7 to 13.5)	11.3 (10.4 to 12.2)	<0.001

\*For comparison between January-June 1990 and January-June 1991

TABLE III—Need for inhaled salbutamol among children receiving regular prophylactic treatment in January-December 1990

Need for salbutamol	Age (years)		P value*
	4-11	12-17	
Drug treatment other than inhaled corticosteroid:			
No of puffs/day:			
Mean	4.6	6.2	<0.001
Median	3.3	4.9	
No of patients	114	338	
Beclomethasone dipropionate:			
50 µg:			
No of puffs/day:			
Mean	4.5	7.4	<0.001
Median	3.8	6.0	
No of patients	99	135	
100 µg:			
No of puffs/day:			
Mean	5.6	8.0	0.013
Median	4.4	6.6	
No of patients	34	145	
Sodium cromoglycate:			
No of puffs/day:			
Mean	4.4	6.1	0.002
Median	2.7	5.5	
No of patients	36	46	

\*Wilcoxon rank sum test comparing children aged 4-11 with those aged 12-17.

consistently receiving prophylaxis. Of those children prescribed inhaled steroids, 15.3% (1061/6952) had six or more prescriptions in the year; of those prescribed sodium cromoglycate, only 6.1% (186/3055) received nine or more prescriptions. The fact that inhaled preventive treatment was being prescribed to the children implied that the general practitioners thought that they were capable of using an inhaler. It was, therefore, surprising that a fairly high proportion of these children were still prescribed oral bronchodilator preparations; this was particularly true of the younger children prescribed sodium cromoglycate (35.5%; 33/93) rather than inhaled steroid (22.7%; 42/185). In the older children the figures were 19.2% (14/73) and 17.9% (60/335) respectively).

Table III shows the numbers of daily puffs of salbutamol, the most commonly prescribed  $\beta$  agonist, according to whether the children received preventive treatment. Significantly larger quantities of salbutamol were used by the older children. The amount of salbutamol prescribed was not significantly different according to whether preventive treatment was given or the type of preventive treatment taken.

A considerable proportion of prescriptions issued for short acting inhaled  $\beta$  agonists recommended that they should be taken three or four times daily (62%; 1310/2121). The frequency of prescription of inhaled salbutamol was similar irrespective of the instruction on the prescription. Thus, patients who were prescribed it to use as needed took on average 4-8 puffs a day.

## Discussion

The aim of this review of general practice prescribing was to study as many asthmatic children as

possible, and 17 846 from all health authorities in Great Britain were included. A tenth (9.6%) of all children aged 4-17 were prescribed some form of treatment for asthma, which is closer to recent estimates of the prevalence of asthma (10-15%)<sup>7</sup> than was the case in 1985 (6.6%).<sup>8</sup> Just over half of asthmatic children were receiving preventive treatment. As expected, most were prescribed bronchodilators, but a remarkably high number were still given oral  $\beta$  agonists when they might have been expected to be able to use an inhaler effectively. The guidelines on asthma treatment recommend inhaled drugs at all times when inhalers can be used effectively.<sup>1,4</sup> Oral bronchodilators were not prescribed as sustained action preparations as most prescriptions were for  $\beta$  agonist syrups, which are less effective than inhaled bronchodilators in terms of time of onset and size of effect.<sup>9</sup> The prescription of oral corticosteroids to just over 9% of asthmatic children may be taken to represent the failure rate of regular treatment in preventing acute exacerbations. This failure rate was high according to the expectations of the consensus guidelines.

## PROPHYLAXIS

The consensus statement suggested that sodium cromoglycate as first line prophylaxis might be expected to be effective in 60% of children requiring preventive treatment,<sup>10</sup> but in the current study I found a progressive decrease in the use of sodium cromoglycate over the 18 months after publication of the guidelines. At the same time the use of inhaled corticosteroids increased, a trend also seen in hospital prescribing.<sup>11</sup> This may in part be because children might be expected to be more compliant with taking inhaled corticosteroids twice daily than with taking sodium cromoglycate three or four times daily. This survey cannot ascertain whether inhaled corticosteroids were prescribed appropriately to children with more severe disease. The results of a recent study in Australia showed overtreatment of mild asthma with inhaled steroids and undertreatment of severe disease.<sup>12</sup>

## BRONCHODILATORS

The consensus guidelines assume from the evidence of controlled clinical trials that the use of regular preventive treatment will reduce the need for short acting  $\beta$  agonists and therefore to reduce this need becomes a key goal in management.<sup>13</sup> If the children in this study were actually taking their preventive treatment when they returned to their general practitioner for regular repeat prescriptions then their need for  $\beta$  agonists was not reduced. Indeed, if anything, children receiving regular prophylaxis, particularly higher doses of inhaled corticosteroids, took increasing quantities of short acting inhaled  $\beta$  agonists. Many were prescribed the short acting inhaled  $\beta$  agonist treatment on a regular basis, which is not part of any recommendation. Among the children using the  $\beta$  agonist as required, however, those taking higher doses of inhaled corticosteroid inhaled more  $\beta$  agonist. This implies that the inhaled corticosteroid was not achieving the degree of control expected from published clinical trials.

Controlled clinical trials achieve far better results than are found in routine clinical practice. The close attention given to patients in a trial with the additional supervision is an added incentive to patients to maintain therapeutic compliance. Furthermore, only patients who show good compliance during routine handling tend to be included in such studies.<sup>14</sup> Clinical practice cannot reproduce the results of a clinical trial, though general practitioners continually strive to achieve this.

## ASTHMA MORBIDITY

A national survey conducted from September 1990

### Key messages

- Monitoring of prescribing practices for children with asthma is necessary to audit the impact of published guidelines
- In 1990 nearly 10% of all children aged 4-17 years received prescriptions for treatment of asthma
- Nearly half of the children were prescribed preventive treatment, but only around 15% were compliant with such treatment
- The use of regular preventive treatment was not associated with reduced use of short acting inhaled  $\beta$  agonists

to February 1991 of 8387 children aged 4-17 with asthma found that a fifth of children awoke at least three times a week because of their asthma and that two fifths awoke at least once or twice a week. Nearly half (49%) of the children experienced asthma symptoms at least every few days and over half (56%) had symptoms at least once a week. When asked about the level of restriction caused by asthma, 28% of children said that they were at least moderately restricted in their day to day activities and almost three quarters (74%) stated that they were restricted to some extent (Action Asthma, national asthma survey 1991, Allen and Hanburys). Although more patients with symptoms may have completed the questionnaire, which would result in bias, the survey's results were in accord with those of other published morbidity surveys.<sup>15</sup> Unfortunately it was not possible to establish whether the children with less severe asthma (half of sample) were those taking preventive treatments. However, the fact that only 14.5% of the whole sample in my current study was prescribed prophylaxis sufficiently regularly to suggest reasonable compliance with preventive treatment may explain the high morbidity.

#### COMPLIANCE

The one factor that might have confounded data collection is that patients might have obtained their drugs from an alternative source, such as hospital clinics. This is unlikely as they still returned to their general practitioners regularly for prescriptions for  $\beta$  agonists but not for prophylactic treatment. It was obviously impossible in a survey such as this to establish whether the patients were truly complying with treatment. The estimate based on repeat prescriptions is more crude but, nevertheless, revealing. The true compliance can only have been worse; indeed, faulty inhalation technique, which is common, means that drugs rarely reach the airways. Even adults are poor at optimising inhalation techniques.<sup>16</sup> Furthermore, a large number of prescriptions are not redeemed.<sup>17</sup>

Although more children are being treated for asthma, the indices of illness remain depressingly poor. Too few children are prescribed preventive treatment and too many are prescribed oral  $\beta$  agonists. This contrasts with prescribing in hospital paediatric asthma clinics in

1991, where 59% received inhaled steroids and 33% either sodium cromoglycate or theophyllines.<sup>18</sup> Even with preventive treatments, in 1990 children were still prescribed large quantities of short acting inhaled  $\beta$  agonists, either by recommendation on the prescription or as necessary. The controversy over the regular use of inhaled  $\beta$  agonists has led to many publications,<sup>19</sup> the latest study seeming to vindicate patients' tendency to take frequent doses.<sup>20</sup> Although high use of  $\beta$  agonists may represent a continued underusage of higher dose inhaled corticosteroids in severe asthma, such inhaled corticosteroids may have long term adverse effects.<sup>21</sup> Large intention to treat trials of prophylaxis with a particular focus on monitoring compliance and the requirement for inhaled short acting  $\beta$  agonists would address this issue. Furthermore, the publication of guidelines is but the first step in tackling the problem of asthma. A massive education exercise for all health professionals, patients, and parents is also required.

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