Primary care workload and prescribing costs in children

The impact of respiratory symptoms

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ABSTRACT

Aim: To examine the relationship between responses to a respiratory questionnaire and primary healthcare utilisation in children.

Method: A stratified random sample of 713 children was selected from respondents to a postal respiratory questionnaire carried out in two general practice populations in 1993. Children were stratified into four groups according to the number of positive responses to five key questions. These groups were used as indicators of likelihood of asthma diagnosis. A search was made of the children's records covering a two-year period which included home visits, surgery consultations and prescribed medications.

Results: As the number of positive responses increased, there was a significant increase in the proportion of children having consultations, home visits and prescriptions, particularly for treatment for respiratory illness. Furthermore, there was a significant relationship between cost and the number of positive responses to the questionnaire ($p < 0.001$).

Conclusions: As likelihood of asthma diagnosis increased in this population, more demand was made upon primary care resources for treatment for respiratory illness. The method developed here to quantify demand enables prediction of healthcare utilisation with regard to respiratory illness in other primary care populations.

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INTRODUCTION

There is strong evidence of an increasing prevalence of respiratory symptoms in children in the UK.^{1–3} The natural history may also be changing, with an increasing prevalence of persistent wheeze, but a decline in frequency of severe attacks.⁴ In order to predict demand, plan the provision of health services and evaluate the relative costs and benefits of different interventions, it is essential to determine patterns of healthcare utilisation.

A large proportion of the burden of asthma care is met by general practice,^{5–7} and it has been reported that a large proportion of related medication costs may be consumed by a small proportion of patients with more severe disease;^{5,8,9} however a reliable method for quantifying this has yet to be found. Furthermore, the morbidity statistics from general practice¹⁰ show that respiratory illness was the most common reason for consulting in primary care. Over 30% of the sample consulted at least once with a respiratory condition in the year 1991–2 (adults and children), indicating a significant consulting rate.

So far, most studies of the economic implications of asthma have used generalisations made across countries or regions.¹¹ In particular, relatively little is known about the healthcare utilisation of children with asthma.^{5,7,12,13}

The study forms part of the Wythenshawe Community Asthma Project (WYCAP),^{14–16} a long-term prospective study into the natural history of asthma in two

neighbouring general practice populations in South Manchester. The main aim of this study is to explore the relationship between respiratory illness and healthcare utilisation. The data will provide a framework for determining the economic costs of asthma in a given population, and for decision making regarding resource allocation. The ultimate objective is to develop a method for quantifying the actual cost of an individual to the National Health Service (NHS). This is an essential part of the modern NHS, as healthcare rationing – though unpopular – is necessary in order to distribute scarce resources to those who require them.^{17,18} In order to make informed choices regarding resource allocation, methods of calculating the actual cost of an illness are needed. Once the method has been defined it can be applied to other populations and possibly other illnesses.

METHOD

In 1993, a questionnaire based on that used in the International Study of Asthma and Allergies in Childhood (ISAAC),¹⁹ was sent to the parents of all children (aged under 16) registered with two general practices situated on a housing estate in Wythenshawe, South Manchester. The majority of the population were Caucasian and lived on the housing estate, which had a high level of deprivation. The ages of the children ranged from less than one year to 15 years old. In order to identify children likely to have asthma, a simple scoring system was developed¹⁸ based on the number of positive responses to five key questions:

1. Has your child had wheezing or whistling in the chest in the last 12 months?
2. In the last 12 months, has your child had a dry cough at night, apart from a cough associated with a cold or chest infection?
3. Has your child had more than three courses of antibiotics for respiratory infections (chest, ears or throat) in the last 12 months?
4. Has your child had hay fever or eczema?
5. Has anyone in your child's family (parents, grandparents, sisters or brothers) had asthma?

The 2659 respondents to the 1993 questionnaire were stratified into four categories according to the number of positive responses made to the five key questions. The four categories were zero positive responses, one to two, three, and four to five. Two hundred respondents (100 from each general practice population) were randomly selected from each category, a total sample of 800 children. Sample sizes were calculated based on the method described by Breslow and Day.²⁰

A search of the general practice paper and computer medical records of each child was made, looking for details of all surgery consultations, home visits and prescribed medications during a two year period (01/05/93–30/04/95). The search was conducted over a period of six months between 1995 and 1996 by a

general practitioner (GP) and a research assistant. Although both were aware of the responses to the questionnaire, the health utilisation data were recorded in a standardised format, in order to reduce opportunity for information bias. All coding difficulties were dealt with by the GP.

Surgery consultations were categorised into one of three groups depending on the main morbidity presented: lower respiratory, upper respiratory (including all ear, nose and throat conditions) and non-respiratory conditions. If the child was seen for more than one condition (for example, for a lower respiratory and non-respiratory condition) 0.5 of a consultation was allocated to each category. All (including repeat) prescriptions issued during the observation period were recorded according to *British National Formulary (BNF)*²¹ groupings, including dosage, amount and strength. For analysis, prescription data were subdivided into respiratory (*BNF* section 3 – respiratory system, 5.1 – antibacterial drugs and 6.3 – corticosteroids) and non-respiratory (all other *BNF* sections). Antibacterial drugs and corticosteroids were included in the respiratory category as these medications are mostly prescribed to children for respiratory conditions. In some analyses, respiratory medications were subdivided into inhaled bronchodilators (*BNF* section 3.1), inhaled corticosteroids (3.2), antibacterial drugs (5.1) and corticosteroids (6.3). A computer program from the Prescription Pricing Authority assigned net ingredient costs to each medication. The percentage of children having a surgery consultation, home visit or prescription were compared across positive response categories.

Analysis was carried out using SPSS for Windows (version 6).²² The data were very highly positively skewed i.e. there were many children who had none or very few consultations or prescriptions. This had implications for the analysis of the data, in that non-parametric statistics were most appropriate. Therefore, the percentage of children having each type of consultation and prescription by positive response category was considered. The relationship between utilisation and positive response categories was analysed using the χ^2 test. Discrete numbers of positive responses (0, 1, 2, 3, 4, 5) were used in the χ^2 analysis. The mean and median values for cost of prescriptions were calculated, and the Kruskal–Wallis test was used to analyse the relationship between the cost of prescriptions and the positive response categories. Ethical approval for the project was received from South Manchester Medical Research Ethics Committee.

RESULTS

The response rate to the questionnaire was 75% (2659 responders). Of the 800 children selected, adequate information for analysis was available for 713 children (Table 1). Most of the excluded 87 children had moved away from the practice during the study period. There were approximately equal numbers of children in each of the main age groups and positive response groups. The mean overall age of the sample was 7.5 years. Table 1 also shows the mean age of the children in each positive response category. Although there was a higher proportion of females

than males in the three or more positive responses group, this difference did not reach statistical significance ($p=0.135$).

The 713 children had 5055 practice-based consultations during the two year period. The proportion of children having practice-based consultations increased significantly (Table 2) as the number of positive responses increased in all conditions ($p=0.027$), but particularly for lower and upper respiratory problems ($p<0.001$). This increase was not evident among non-respiratory morbidities.

A total of 796 home visits were made to the children during the observation period. There was a significant increase in the proportion of children having a home visit as the number of positive responses increased, for all conditions ($p=0.001$), and again specifically for respiratory consultations ($p=0.001$; Table 2).

The total number of prescriptions issued to the 713 children was 7466 at a total ingredient cost of £35,455.91. There is a significant increase across positive response categories in the proportion of children having a prescription for any illness ($p\leq 0.001$), however the trend does appear more marked for respiratory prescriptions (Table 2). When respiratory treatments were separated into different types of medication, there was a clear increasing trend across positive response categories. The significant trend is especially clear for bronchodilators and inhaled steroids ($p<0.001$). As oral steroids were not prescribed frequently, the values shown appear as zero, however only those in the three or more positive response group were prescribed oral steroids.

Table 3 shows a significant relationship between positive response category and the cost of prescriptions, as shown by the Kruskal–Wallis test ($p<0.001$). Twenty one children (10.9% of those answering three questions positively) with three positive responses and ten (5.3% of children in the four to five positive response category) with four or more positive responses had no respiratory consultations, home visits or prescriptions during the two-year observation period.

DISCUSSION

This paper examines primary healthcare utilisation over a two-year period by a group of children according to their number of positive responses to a postal respiratory questionnaire. There were highly significant positive associations between the number of positive responses to the key questions and number of consultations at surgeries, home visits and medication prescribed.

An evaluation of the scoring system used in this study to detect possible asthma has been described elsewhere.¹⁸ Consensus expert opinion was used to determine those children aged five to 15 years old

Table 1: Number of responders to the respiratory questionnaire, and the number eventually included in the analysis

Number of positive responses	All 1993 responders	Selected	Available for analysis	Mean age (standard deviation)
0	629	200	165	8.8 (4.1)
1–2	1296	200	167	8.2 (4.3)
3	322	200	192	6.3 (4.3)
4–5	316	200	189	6.5 (3.9)
Total	2563	800	713	7.4 (4.3)

Table 2: Percentage of children having at least one consultation or prescription in primary care by positive responses

	Positive response category				χ^2 test for linear trend ^a	p value ^a
Total in each group	0	1–2	3	4–5		
Total surgery consultations	92.7%	98.8%	96.4%	98.4%	4.89	0.027
Lower respiratory consultations	3.0%	5.4%	18.2%	23.3%	42.96	<0.001
Upper respiratory consultations	51.5%	59.8%	72.4%	74.1%	25.22	<0.001
Non-respiratory consultations	89.1%	93.4%	90.1%	93.7%	1.27	0.259
Total home visits	34.5%	46.1%	52.1%	55.0%	13.95	0.001
Lower respiratory home visits	3.0%	5.4%	18.2%	23.3%	42.96	<0.001
Upper respiratory home visits	18.8%	26.3%	33.8%	32.3%	10.22	0.001
Non-respiratory home visits	18.2%	24.5%	23.4%	27.5%	1.89	0.169
Unknown cause home visits	4.8%	4.8%	10.4%	10.1%	4.36	0.037
Total number of prescriptions	81.2%	91.6%	92.7%	97.4%	25.8	<0.001
Non-respiratory prescriptions	70.3%	83.2%	82.3%	86.2%	11.41	0.001
Respiratory prescriptions	67.3%	72.4%	86.4%	93.6%	50.10	<0.001
BNF 3.1 ^b prescriptions	9.1%	13.7%	50%	65.1%	168.65	<0.001
BNF 3.2 ^c prescriptions	1.8%	3.6%	20.3%	39.7%	112.84	<0.001
BNF 5.1 ^d prescriptions	55.7%	61.1%	76.0%	83.1%	38.15	<0.001
BNF 6.3 ^e prescriptions	0.6%	0%	8.3%	9.0%	25.57	<0.001

^aCalculated using discrete positive response values; ^bbronchodilators; ^cinhaled steroids; ^dantibiotics; ^eoral steroids

who were likely to benefit from a trial of treatment, based on a full clinical examination of a random sample of children from a subsequent survey. This showed that increasing numbers of positive responses increases the likelihood of benefit from a trial of asthma medication, and found a high positive predictive value (PPV) of three or more positive responses in identifying such children (PPV 84%; 95%CI 74–90). In this study, it is those children that were in the three, and four to five positive responses groups that had proportionally more consultations, home visits and prescriptions, especially for upper and lower respiratory illness. It must be borne in mind however, that the questionnaire has not been validated in children under five.

There was no significant increase in the proportion of children having a consultation or home visit for non-respiratory illness across the positive response groups, although significant trends were found for non-respiratory prescriptions. The association with non-respiratory prescriptions persisted even when medications for skin problems (such as eczema) were excluded. It is possible that the association exists because of an artefact of design. For example, if a prescription for paracetamol was given to a child with a respiratory tract infection, the consultation would be recorded as a respiratory consultation and the paracetamol would be coded as a non-respiratory medication.

Ten children with four or more positive responses (5.3% of those with four or more positive responses) had no recorded evidence of respiratory medical care in the two year period. The clinical evaluation of the questionnaire¹⁸ would indicate that all of these children would benefit from a trial of medication (PPV of four or more positive responses to detect children who would merit a trial of asthma medication was 96%; 95% CI 88–99). This has implications if applied in practice as the additional costs of treating previously undiagnosed asthmatics have to be

recognised. This study provides the data required to quantify these costs.

To determine whether any bias may have occurred in the study, two possible sources were examined. Firstly the non-responders to the 1993 questionnaire were compared with the responders with respect to gender, age, total number of consultations and respiratory consultations in 1993 and secondly the 87 children excluded from the analysis were compared with the 713 children included on age, gender and bronchodilator medication prescribed in the year before 1993, no significant differences were found.

A possible limitation of the study was that the data collected from general practice records were from two practices, with differing methods of data recording, however there were no substantial differences in the main outcome variables between practices. Further, some records may have been incomplete, but the highly significant trends found in the data suggest that any influence from incomplete data would not alter the overall conclusions. In addition, all medications recorded in the practice notes are a record of prescriptions given, not necessarily prescriptions dispensed. There were 21 children under one, which would have affected their parent's ability to respond to the key questions relating to symptom reporting over a period of twelve months. Finally, as the two researchers involved in data collection were not blind to the responses to the questionnaire, there was opportunity for bias in recording of the consultations and prescriptions, however, as the data were recorded in a uniform manner, any effect would be minimal.

Most previous studies of healthcare utilisation^{5,7,12,13} have considered only those patients whose symptoms are known to their doctor, and have therefore given lower consultation and prescribing rates than those found here. In the present study, it was possible to include children with no symptoms and those with symptoms unknown to their doctor. A recent study²³ has reported a positive association between consultation rates and the number of respiratory symptoms; although direct comparison with this study is impossible due to methodological differences.

This study has several strengths in that the questionnaire provides a standardised measure of respiratory symptoms, the study period covers two years, and a wide age range (under one to 15 years), the data are actual consultations and prescriptions, and are therefore relevant to general practice, and finally all prescriptions given were recorded, to enable consideration of specific drugs and prescribing patterns as a whole.

The proportion of children having a primary care consultation or a prescription increased as the number of positive responses to the questionnaire increased. This has implications for the planning and resourcing of services. These findings actually quantify the proportion of healthcare consumed by specific groups in this population. Although the sample used in this

Table 3: Median (interquartile range) cost (£) of prescriptions over the two-year period

Number of positive responses	Total cost	Non-respiratory medication ^a	Respiratory medication ^b	Section 3.1 (bronchodilators)	Section 3.2 (inhaled steroids)	Section 5.1 (antibiotics)	Section 6.3 (oral steroids)
	£35,455.91	£11,867.78	£23,588.13	£7014.94	£8676.77	£3572.33	£31.90
0	5.85 (0.90– 17.01)	2.25 (0.00– 8.88)	1.63 (0.00– 5.62)	0 (0)	0 (0)	0.92 (0.00–3.40)	0 (0)
1–2	8.98 (3.57– 19.82)	5.08 (1.19– 12.01)	2.54 (0.00– 6.38)	0 (0)	0 (0)	1.51 (0.00–4.59)	0 (0)
3	19.24 (6.17– 52.27)	5.63 (1.22– 16.22)	7.95 (1.75–23.26)	0.26 (0.00– 7.70)	0 (0)	2.74 (0.48–7.09)	0 (0)
4–5	34.52 (11.69–101.95)	6.81 (1.83– 20.31)	19.47 (5.67–70.06)	3.36 (0.00–17.64)	0 (0.00–24.55)	4.64 (1.11–9.63)	0 (0)
Test statistic	KW=117.505	KW=24.293	KW=160.614	KW=181.083	KW=118.426	KW=63.516	KW=27.585
p	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

^aAll medication not classified as respiratory; ^bMedication in BNF sections 3.1–3.10 (respiratory), 5.1 (antibiotics) and 6.3 (oral steroids)

study is not representative of the entire UK population, a method has been developed that could be applied elsewhere. The difference in proportions of children receiving healthcare for each level of positive response could be applied in other populations. For example, the questionnaire could be administered to the children in a general practice population and their response used to gauge the likely demand for primary care. There are plans to replicate this study in other locations, to determine whether these findings can indeed be generalised.

Proportions of children who did and did not receive primary healthcare are reported here. The actual data set includes data on exactly how many consultations, home visits and prescriptions each child had. These data will be used, when the healthcare utilisation is costed, to provide accurate costs for primary and ultimately secondary care for treating respiratory illness. Although primary care forms a major part of total healthcare utilisation, consideration of secondary care, and the relationship between primary and secondary care,^{24,25} is essential in order to gain a full account of the impact of respiratory symptoms in children on the health services, and to enable evidence-based resource allocation. Relevant data on secondary healthcare utilisation have been collected and, in future papers, will be combined with the data presented here. Furthermore, using the same population's responses to the same questionnaire distributed two, and again six years later, will enable comparison of clinical outcomes. In this way, it will be possible to obtain a comprehensive interpretation of the impact of respiratory illness in childhood on the NHS. ■

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