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Rates of admission to hospital for asthma

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Abstract

Objective—To describe trends in hospital admission rates for asthma in England and Wales (1976-85), the East Anglian region (from 1976 to 1991-2), and Wales (1980-90).

Design—Descriptive study.

Setting—Hospitals in England and Wales; hospitals in the East Anglian Regional Health Authority; hospitals in Wales.

Main outcome measures—Hospital admissions for asthma as principal diagnosis in England and Wales (Hospital In-patient Enquiry, 1976-85), for the East Anglian region (Hospital In-patient Enquiry, 1976-7; Hospital Activity Analysis, 1978-86; Regional Information System, 1987-8 to 1991-2), and for Wales (Hospital Activity Analysis, 1980-90).

Results—Rates for England and Wales as a whole showed a steady upward trend throughout the period examined. Rates in East Anglia, though they were similar to the national trends in the early years, showed a peak in 1985 (for males and females) with some indication of a decline in rates thereafter. Rates for Wales showed an upward trend until 1988 (for both males and females) after which they showed a decline.

Conclusions—Interpretation of the East Anglian trends is made more difficult by the change in England in 1987 of the system for the collection of hospital admission data. The fact that the rates for the East Anglian region seem to decline before this change and other considerations suggest that the observed trends, although partly reflecting the disruption of the coding during the changeover in systems, may not be entirely artefactual. The possible roles of diagnostic transfer and changes in the delivery of care, asthma treatment, admission and readmission policies, and the severity and preva-

lence of asthma in changing admission rates are considered. The changing trends in admission rates for East Anglia and Wales reflect recently published trends for mortality from asthma in England.

Introduction

There has been considerable interest in hospital admissions attributed to asthma over the past three decades. For England and Wales, Mitchell used data from the Hospital In-patient Enquiry to describe a sixfold increase in admission rates for 0-14 year olds from 1957 to 1981.¹ Similar trends have been described in the United Kingdom,^{2,4} New Zealand,⁵ Australia,⁶ and the United States.⁷ The reasons for these increases are still debated, although there is some evidence to suggest that they may be due to the transfer of cases from other categories of disease (diagnostic transfer)⁶ or to changes in medical practice.⁸ It has also been suggested that there has been a change in the severity³ or prevalence of asthma.^{9,10}

At present, data on hospital admission rates for England and Wales as a whole are available from Hospital In-patient Enquiry reports published up till 1985. The regional system on which the Hospital In-patient Enquiry was based (Hospital Activity Analysis) continued until the end of 1986, but no national summary was published for that year. The Hospital Activity Analysis data have been replaced in England and Wales after the changes introduced in NHS information systems by the Körner committee. Data (now based on the financial year) are collected locally by a regional information system and collated nationally as hospital episode statistics. Data from these statistics are so far available only for the year 1989-90.¹¹ For England and Wales as a whole, therefore, it is not possible to examine admission rates

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continuously beyond 1985. Analyses at regional level, however, are possible. Any examination of trends is problematic when changes in methods of data collection occur, so data were also obtained from Wales, where the change from Hospital Activity Analysis to the new system did not occur until 1991.

Methods

We present hospital admission rates for asthma for England and Wales for the years 1976 to 1985 by using data from the Hospital In-patient Enquiry (for example, reference 12); for Wales from 1980 to 1990 by using data from Hospital Activity Analysis; and for the years 1976 to 1991-2 for the East Anglian Regional Health Authority (population 2 million). The latter are calculated from the inquiry data for 1976 to 1977 (local data are not available for these years), from analysis data from 1978 to 1986, and from data from the regional information system from 1987-8 to 1991-2.

Age and sex specific admission rates (calculated by using age groups 0-4, 5-14, 15-44, 45-64, and 65 and over (East Anglian region); 65-74 and 75 and over (England and Wales as a whole and Wales)) attributed to asthma (International Classification of Diseases, Ninth revision, rubric 493; ICD A list rubric A93b) as principal diagnosis were calculated. This was done using population figures taken from census estimates for the East Anglian region from the Hospital Inpatient Enquiry (1976-9) and from data provided by the East Anglian Regional Health Authority Statistics and Information Division (for 1980 to 1991-2); for Wales from the Hospital In-patient Enquiry (1980-4) and from the Welsh Office, Cardiff (1985-90); and for

England and Wales as a whole from Hospital In-patient Enquiry estimates. Standardised sex specific rates were calculated (by using the direct method) with the 1981 census data for the United Kingdom as the standard population.

To investigate the possibility that the increasing asthma admission rates seen in the 1970s and early 1980s have declined in recent years we calculated the 95% confidence intervals for observed admissions for the year 1991-2.¹³ These were then compared with asthma admission rates predicted for 1991-2 on the basis of linear trends observed from 1976 to 1985. Predicted rates were calculated by extrapolating the line of best fit for these years to 1991-2.

Rates were extrapolated by using two starting points; the first, from 1979, coincided with an apparently steeper increase in admission rates which continued until 1985. The second point taken was 1976, which produced a more conservative predicted increase for 1991-2 and was based on trends more representative of the years before 1976.¹

Results

Figure 1 shows age standardised admission rates for males and females for England and Wales (1976-85) and for the East Anglian region (from 1976 to 1991-2). For both sexes admission rates for England and Wales clearly rise from 1976 to 1985. For the East Anglian region rates for males and females show an overall upward trend until 1985. After this year admission rates fall for both sexes, rise at the introduction of the regional information system, fall again after 1988-9, and then rise again in 1991-2, reaching a similar admission rate to that shown before the introduction of the new system in 1985.

Based on the trends extrapolated from 1976 the asthma admission rate for 1991-2 was predicted as 18.7 per 10 000 for males and 16.8 for females. The observed rates for this year were 14.4 (95% confidence interval 13.6 to 15.1) for males and 13.3 (12.6 to 14.0) for females. The upper confidence limits for asthma admissions for both sexes, therefore, fall well below the predicted rates based on trends from 1976 to 1985. This indicates that the increasing trends of asthma admissions observed before 1985 have not been continued in recent years. Figure 2 shows that for Wales there was an upward trend for both sexes until 1988 and then a decline.

Table I shows the asthma admission rates specific for sex and age for the East Anglian region, table II shows the same data for Wales, and table III for England and Wales as a whole (until 1985). These indicate that the most dramatic increase in admission rates during the first part of the 1980s occurred in the 0-4 year age group for both sexes.

The decline in admission rates occurred for most age groups and both sexes in the East Anglian region after the mid-1980s, after which the pattern of admissions

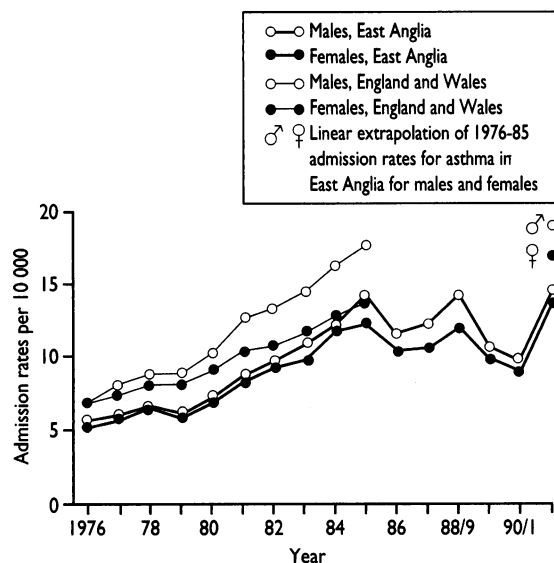


FIG 1—Age standardised admission rates for asthma as main diagnosis for England and Wales from 1976 to 1985 and the East Anglian region from 1976 to 1991-2

TABLE I—Age specific rates (per 10 000) for admission to hospital for asthma for East Anglian region from 1976 to 1991-2

Age (years)	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987-8	1988-9	1989-90	1990-1	1991-2
0-4:																
Males	12.44	16.23	21.81	13.47	34.83	43.83	57.12	56.27	70.55	80.94	70.46	76.90	90.01	66.32	66.37	87.66
Females	3.32	6.90	8.87	14.21	26.04	26.51	32.76	30.73	42.74	36.90	33.49	42.06	47.12	38.86	36.49	41.03
5-14:																
Males	8.23	7.48	11.59	10.98	10.16	14.03	15.69	18.26	19.98	20.64	18.55	21.95	22.60	16.59	12.11	20.06
Females	5.80	5.75	8.61	11.58	6.98	10.72	11.86	14.11	14.16	13.03	12.45	14.03	13.32	11.54	7.38	13.84
15-44:																
Males	4.34	3.28	2.97	3.40	2.70	3.64	3.26	4.00	3.68	5.35	4.23	4.42	5.37	4.52	4.25	5.94
Females	4.81	5.28	5.43	3.72	3.97	5.74	6.03	6.39	8.05	9.00	7.10	7.56	8.28	7.75	6.61	11.38
45-64:																
Males	5.60	6.11	6.62	6.59	5.26	5.17	5.84	6.42	7.16	7.97	6.35	5.85	5.91	4.34	4.46	7.12
Females	5.42	7.41	6.92	5.38	5.95	6.37	6.76	7.55	8.91	10.97	8.71	8.61	10.17	7.17	8.16	11.13
≥65																
Males	2.81	8.26	5.41	9.83	7.38	7.17	6.01	8.80	9.12	11.71	6.77	4.85	8.81	5.94	5.37	10.62
Females	6.43	4.44	7.05	4.34	8.57	8.50	10.03	10.15	11.56	11.66	11.16	6.96	9.40	7.81	8.38	10.80

TABLE II—Age specific rates (per 10 000) for admission to hospital for asthma for England and Wales from 1976 to 1985

Age (years)	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
0-4:										
Males	21.14	25.71	30.93	32.00	41.36	57.13	66.45	71.63	88.76	95.81
Females	14.54	15.96	20.87	20.73	26.10	28.97	33.85	40.34	45.78	46.75
5-14:										
Males	11.92	15.52	16.99	17.57	19.85	24.87	26.06	29.01	31.59	32.65
Females	7.99	8.92	9.64	10.53	13.02	14.97	15.76	17.66	18.90	19.51
15-44:										
Males	3.55	4.12	4.16	4.09	4.63	5.32	4.91	5.40	5.37	6.48
Females	5.44	6.16	6.49	6.48	6.37	7.66	7.54	7.93	8.68	9.71
45-64:										
Males	6.00	6.29	6.07	6.23	6.67	7.40	7.85	7.82	8.59	9.67
Females	7.32	7.59	7.81	7.67	8.07	8.89	8.60	9.49	9.77	11.67
65-74:										
Males	5.96	7.13	7.58	7.52	6.32	8.07	7.74	9.42	9.75	8.68
Females	7.49	6.91	8.00	8.01	8.72	9.39	9.63	8.90	11.00	10.73
≥75:										
Males	4.50	3.76	5.53	4.00	7.19	6.21	5.80	5.61	7.62	8.62
Females	4.30	4.94	4.72	5.05	5.98	7.08	7.57	6.96	8.78	9.17

TABLE III—Age specific rates (per 10 000) for admission to hospital for asthma for Wales from 1980 to 1990

Age (years)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
0-4:											
Males	31.07	50.73	58.14	64.65	86.53	83.55	91.44	105.83	121.37	100.97	88.34
Females	20.86	27.51	27.81	30.55	45.96	39.38	45.62	50.80	63.94	52.44	55.82
5-14:											
Males	21.60	29.17	28.59	33.20	28.91	36.70	37.74	40.28	40.82	31.62	27.82
Females	13.00	17.37	14.74	16.06	19.47	19.73	23.19	25.56	22.20	18.23	19.09
15-44:											
Males	4.85	6.02	5.09	5.27	4.94	6.38	7.58	7.35	6.84	6.32	6.00
Females	9.05	8.57	8.74	8.94	8.78	9.82	11.64	11.21	13.27	12.65	11.33
45-64:											
Males	8.89	10.82	7.06	8.53	10.78	12.98	12.33	12.90	13.32	10.92	9.89
Females	12.58	13.17	11.14	12.86	14.19	17.02	16.37	16.36	18.08	18.73	15.39
65-74:											
Males	8.81	13.12	9.51	9.55	13.85	12.88	13.63	14.61	13.40	14.81	12.16
Females	16.18	13.37	11.97	16.34	16.58	15.29	21.04	16.86	19.53	19.39	20.00
≥75:											
Males	8.95	10.05	5.51	10.07	11.13	14.89	13.33	11.14	14.61	13.48	9.50
Females	10.71	10.29	9.82	12.69	12.12	15.30	16.08	16.38	17.74	16.36	12.36

TABLE IV—Uncoded admissions to hospital for East Anglian region from 1987-8 to 1991-2

Year	Uncoded admissions (%)
1987-8	12.3
1988-9	14.3
1989-90	13.2
1990-1	21.2
1991-2	2.6

follows that of the standardised rates described above. For Wales the rates declined after 1988, again in most age groups.

Discussion

Admissions to hospital are distressing events for patients and their families and account for considerable proportions of the direct and indirect costs of most diseases. For asthma Clark has estimated that hospital admissions cost £57.6m in the United Kingdom in 1988.¹⁴ The need for admission also makes a substantial though currently undetermined contribution to the indirect costs of asthma through days spent away from work and school.

Admission rates attributed to asthma in children have risen in England and Wales over at least three decades.¹ From the data presented here, this is the case for all ages and both sexes from 1976 until 1985. Data for East Anglia also indicate a continued rise until the mid-1980s but some indication of a decline or a slowing

down of rates after this. A similar decline is observed in the Welsh data after 1988. The reasons for decline may be artefactual, real, or a combination of the two.

CODING ARTEFACTS

A major change in data collection took place when Hospital Activity Analysis gave way to regional information systems, and it is clearly important to consider the possible impact this might have had on admission rates in the East Anglian region. The regional information system counts "finished consultant episodes" rather than "deaths and discharges," as did Hospital Activity Analysis. Thus, if a transfer to another specialty had occurred during a stay in hospital under the old system and a diagnosis of asthma had been recorded at the time of transfer but not at the end of the complete stay, that discharge or death would not have been attributed to asthma. In the same circumstance under the regional information system, however, the period of the admission to which a diagnosis of asthma had been attributed would count as one "finished consultant episode" for asthma.

Such a change would have the effect of artificially increasing admission rates from 1987-8. Rates do rise at the discontinuity between the two systems but show some indication of a decline thereafter. It is perhaps important that the trends shown indicate a decline before the changeover in systems. The data from Wales, where no such change in information systems occurred during the study period, also show some indication of a decline in admission rates for asthma.

Despite this it is important to examine other ways in which the changeover in information systems may have influenced the observed trends. One possible effect may be the general disruption of coding during the changeover period. This has been considered by examining data for the completeness of coding for the years after the changeover. It is not possible to obtain data on coding completeness before the changeover. Table IV shows the percentage of uncoded episodes for the years 1987-8 to 1991-2 in the East Anglian region. This indicates that completeness of coding may be contributing to the observed trends in admissions. If this were solely responsible for the apparent decline, however, one might expect the years 1987-8 to 1989-90 to be comparable in admission rates, given the percentage of uncoded admissions for these years. This is not the case. The drop in admission rates in 1990-1 and the apparent rise in admissions in 1991-2 could well be due to coding completeness for these years. It is difficult to explain the apparent decline in admissions before the changeover in systems without data on coding completeness. One suggestion might be that as the changeover in systems was imminent there was a tendency to relax the quality of coding.

The changeover in information systems in Wales occurred in 1991, and it could therefore be argued that this problem of poor coding completeness before a change in information systems may explain the trends seen in Wales from 1988. The observed decrease in asthma admissions between 1988 and 1989, however, actually occurred when the percentage of uncoded admissions remained the same (9%). During 1990, however, there were 16% uncoded admissions, which might have contributed to the further decline seen in the Welsh data between 1989 and 1990.

One important point with reference to the East Anglian data is that, despite 97.4% completeness of coding for 1991-2, asthma admission rates are comparable with the 1985 rates. If the trend observed from 1976 to 1985 is extrapolated to 1991-2 the predicted admission rate is well above the upper confidence intervals of the observed 1991-2 rates for both males and females. If a change in the rate of admissions is being observed it is worth considering why this may be.

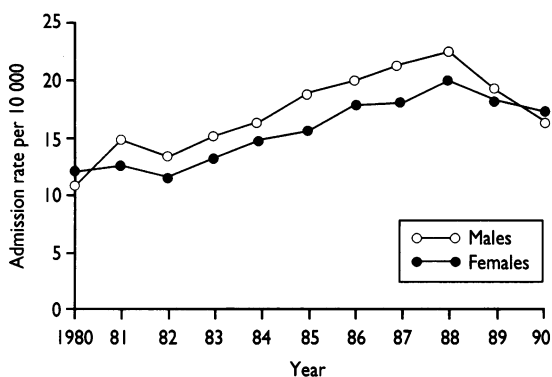


FIG 2—Age standardised admission rates for asthma as main diagnosis for Wales from 1980 to 1990

DIAGNOSTIC TRANSFER

With the exception of one study⁶ most papers discussing diagnostic transfer do not attribute rising admission rates for asthma to a concomitant decline in other respiratory diseases.^{1-3,15} For our data the argument for diagnostic transfer would be that until the mid-1980s clinicians and coders were progressively more likely to code other wheezy conditions as asthma and that since this period they have either established their coding protocols or started to do the reverse. The latter seems rather unlikely.

CHANGES IN DELIVERY OF MEDICAL CARE

Several studies, again seeking to explain increased asthma admissions in children, considered changes in medical care leading to a shift of asthma patients from the community to the hospital setting.⁸ To explain any slowing down or downward trend in asthma admissions a change in this phenomenon would have to be postulated. This is possible. Guidelines for the management of asthma have been published^{16,17} which outline when patients should be referred to hospital. The more assiduous recognition of asthma in general practice has been encouraged, and there are an increasing number of asthma clinics in general practice.¹⁸

CHANGES IN TREATMENT

It has been suggested that the increase in asthma admission rates resulting in a greater use of hospital services might be a reflection of changing treatment. For example, Storr *et al* attributed the rise in self referrals to hospital around 1976 to the provision of nebulised salbutamol there.⁴ Anderson considered that changes in drug treatment generally over the years should have produced a reduction rather than an increase in admissions,¹⁵ although there is still a debate in the literature regarding the possible adverse effects of some asthma drugs.^{19,20} To use these as explanations for possible changing rates would perhaps mean that advances in treatment were finally having an effect or that there was an increasing awareness of the risks of certain drugs.

CHANGING CRITERIA FOR ADMISSION AND READMISSION RATES

Another explanation put forward for increasing asthma admissions has been that the criteria for admitting patients to hospital or readmission rates have changed. These have been considered, but the general conclusions are that they are not important.^{3,4,15,21,22} Table V shows the readmission rates for the East Anglian region (between three and 92 days after their first admission) for 1987-8 to 1990-1. Although the percentage of readmissions varies in the same way as observed trends in admission, the actual proportion remains fairly constant over the period while more dramatic changes occur in the overall trends. It therefore seems unlikely that readmissions are playing a major role in the trends we observed.

CHANGES IN SEVERITY OR PREVALENCE OF ASTHMA

The general conclusions of studies seeking to explain upward trends in admissions for asthma have been that the severity³ or the prevalence^{9,10} of asthma is increasing. Given that a change in trend is now observable, at least in the East Anglian region and in Wales, is it possible that the severity or prevalence of asthma are changing. If this is so, why?

Changes in prevalence or severity may be due to a number of factors including environmental pollutants or aeroallergens. For East Anglia smoke and sulphur dioxide levels have on the whole been declining during the 1980s (data supplied by Warren Spring Laboratory, Department of the Environment, 1992). There has

Clinical implications

- Hospital admissions attributed to asthma have been increasing for the past three decades
- No truly satisfactory explanation for these trends has been put forward, although several potential reasons have been discussed
- This study indicates that in the East Anglian region and Wales at least there may now be a change, even a decline, in asthma admission rates
- This possible decline is given some support by a recent decline in mortality for asthma
- If asthma admission rates are changing, it is important to consider why this may be. Several factors, both real and artefactual, are discussed

been no accurate monitoring of aeroallergens during this period.

CHANGES IN MORTALITY

The possibility of a true change in asthma morbidity is given some support by recent data on asthma mortality for England (data from the Office of Population Censuses and Surveys, collated by the central health monitoring unit of the Department of Health). These trends are shown in figure 3. It is clear that as there is some evidence of a change in hospital admission rates in the East Anglian region and in Wales in the mid to late 1980s so there is decreasing mortality for England for the same period. Mortality has not undergone any radical change in recording over this time, and yet there is still a clear reversal of the upward trend seen in earlier years.

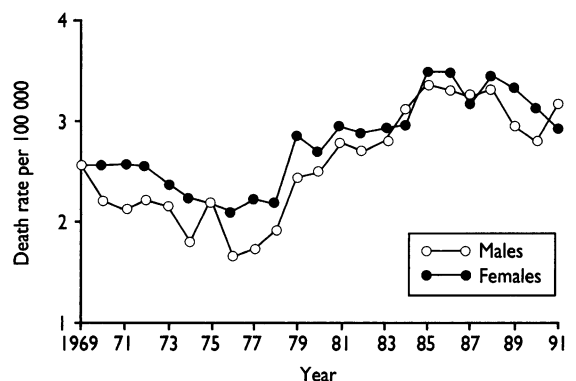


FIG 3—Age standardised death rates for asthma for England from 1969 to 1991 (Rates calculated using the European standard population. There is discontinuity between years 1978 and 1979 due to change in classification and between 1983 and 1984 due to change in coding procedures. This may affect the comparability of the data)

CONCLUSIONS

We have presented evidence suggesting a possible change in the recent trends for hospital admissions attributed to asthma in East Anglia and in Wales. Given the problems with coding completeness resulting from the change in information systems it is difficult to conclude that admission rates are changing for the better. On the basis of the analysis comparing predicted and observed admission rates for 1991-2 in the East Anglian region, however, one could conclude that admission rates for 1991-2 are lower than expected and may represent a change in current trends.

Once the new information system has been successfully running for several years it will be possible to confirm or refute this finding. The reasons for a possible change are not entirely clear. Diagnostic

TABLE V—Percentages of admissions for asthma readmitted with asthma between three and 92 days after first admission for East Anglian Regional Health Authority from 1987-8 to 1990-1

Year	Readmission rate (%)
1987-8	14.7
1988-9	17.3
1989-90	16.1
1990-1	15.6

transfer, changes in the delivery of medical care, improvements in treatment, or environmental factors may be playing a part.

One important additional finding of this work is that during the change in information systems, for asthma admissions at least, there were up to six years of disruption which may affect other trend analyses for different diseases during this period. Rates of hospital admission attributed to asthma have been increasing for many years. No entirely satisfactory explanation has been put forward for the observed increases. The possibility that they may now be changing presents yet more interesting questions relating to the aetiology and epidemiology of this disease.

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Trends in prevalence and severity of childhood asthma

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Abstract

Objective—To test the null hypothesis that there has been no change in the prevalence or severity of childhood asthma over recent years.

Design—Repeated population prevalence survey with questionnaires completed by parents followed by home interviews with parents.

Setting—London borough of Croydon, 1978 and 1991.

Subjects—All children in one year of state and private primary schools aged 7½ to 8½ years at screening survey.

Main outcome measures—Trends in symptoms, acute severe attacks, and chronic disability.

Results—For 1978 and 1991 respectively, the response rates were 4147/4763 and 3070/3786, and home interviews were obtained from 273/288 and 319/395 parents of currently wheezy children. Between 1978 and 1991 there were significant relative increases in prevalence ratios in the 12 month prevalence of attacks of wheezing or asthma (1.16; 95% confidence interval 1.02 to 1.31), the one month prevalence of wheezing episodes (1.78; 1.15 to 2.74), and the one month prevalence of night waking (1.81; 1.01 to 3.23) but not in frequent (≥ 5) attacks over the past year (1.05; 0.79 to 1.40). There were substantial and significant decreases in the 12 month prevalence of absence from school of more than 10 days due to wheezing (0.52; 0.30 to 0.90), any days in bed (0.67; 0.44 to 1.01), and restriction of activities at home (0.51; 0.31 to 0.83) and an equivalent but not significant fall in speech limiting attacks (0.51; 0.24 to 1.11).

Conclusion—The small increase in the prevalence of wheezy children and relatively greater increase in persistent wheezing suggests a change in the environmental determinants of asthma. In contrast and paradoxically the frequency of wheezing attacks remains unchanged and there are indications that severe attacks and chronic disability have fallen by about half; this may be due to an improvement in treatment received by wheezy children.

Introduction

Four prevalence studies which have been repeated over time with similar methods have all reported that among British school children the prevalence of symptoms of asthma has increased in recent years.¹⁻⁴ This trend in prevalence has been accompanied by an increase in children consulting their general practitioner with asthma^{5,6} and in hospital admissions,⁷ but opinions vary about the extent that this increase is due to epidemiological factors rather than to artefacts or changes in medical care.^{1,8} The widespread acceptance that asthma is indeed on the increase has created considerable concern about what kinds of environmental factors might be responsible.

Hitherto, serial prevalence studies have relied mainly on a simple respiratory questionnaire which is completed by parents, though in one study there was corroboration with an exercise test for bronchial hyperreactivity.¹ So far, no study has used a detailed interview of parents to ascertain in a standard manner trends in clinical details or the impact of the disease in terms of severity and disability.

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