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Influence of family factors on asthma and wheezing during the first five years of life

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Leeder, S. R., Corkhill, R. T., Irwig, L. M., Holland, W. W., and Colley, J. R. T. (1976). *British Journal of Preventive and Social Medicine*, **30**, 213-218. **Influence of family factors on asthma and wheezing during the first five years of life.** Family factors associated with the incidence of asthma and wheezing during childhood have been studied in a cohort of over 2000 children who, together with their families, were followed-up for five years. Episodes of wheezing not regarded by the parents as asthma had a different pattern of association with family factors to that found for asthma. The outcome of the two conditions in terms of ventilatory function at the age of five years was also different, in that children with a history of asthma had a lower peak expiratory flow rate than did children with a history of non-asthmatic wheezing.

Attacks of wheezing are common events in childhood in the United Kingdom. Two studies showed that some 20% of children received attention from their general practitioner for at least one episode of wheezing during their first decade (Fry, 1961; Goodall, 1958). The relationship between attacks of wheezing accompanying acute lower respiratory infection, sometimes termed wheezy bronchitis, and wheezing precipitated by allergens, emotional stress, or exercise is particularly difficult to define (*British Medical Journal*, 1973; Gordis, 1973). It is likely that in some cases episodes of wheezing mark the beginning of chronic bronchial asthma (Williams and McNicol, 1969; Gandevia *et al.*, 1973). In this paper we report observations on different family factors associated either with episodes of wheezing considered by parents not to be asthma, and with what the parents termed asthma, in over 2000 children who were studied, together with their families, until the children were five years old. We reasoned that if all attacks of wheezing were in reality mild attacks of asthma, they would be associated with the same family factors as frank asthma.

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Methods and Materials

The methods and materials pertaining to this study are described in the preceding paper.

Results

By the age of five years, one or more episodes of asthma had been reported in 3·4% of boys and 2·9% of girls. Wheezy, whistling, or chesty episodes without asthma were reported in 22·5% of boys and 20·7% of girls.

Episodes of wheezing rather than asthma were associated with a history of bronchitis or pneumonia in children during their first year of life, 41·2% of children with a history of bronchitis or pneumonia in the first year subsequently suffered from wheezing, compared with 19·2% of children without bronchitis or pneumonia (Table I: relative risk for wheeze is 2·15). Asthma was not so strongly associated with bronchitis or pneumonia in the first year, 4·3% of children with this history suffered from subsequent

TABLE I

INCIDENCE PER 100 INDEX CHILDREN OF WHEEZING* IN FIRST FIVE YEARS OF LIFE BY BRONCHITIS OR PNEUMONIA IN FIRST YEAR, AND BY PARENTAL ASTHMA-WHEEZE

		Parental Asthma-Wheeze			
		Neither	One	Both	Total
Bronchitis or pneumonia in the first year	No	17·7 (1333)	24·2 (421)	16·0 (50)	19·2 (1804)
	Yes	37·7 (138)	46·8 (77)	44·4 (18)	41·2 (233)
	Total	19·6 (1471)	27·7 (498)	23·5 (68)	21·7 (2037)†

Populations in parentheses
*Wheezing excludes children who had asthma.
†Total excludes 96 index children with missing first, third, fourth, and fifth year data and an additional 16 with missing initial data on parent pairs.

asthma, compared with 3·0% of children without this history (Table II: relative risk for asthma is 1·41). In children with one parent with a history of asthma-wheeze, the incidence of asthma was 5·4% compared with 2·5% of children whose parents were both free of asthma-wheeze. The incidence of wheezing was also higher in children with one parent with a history of asthma-wheeze (27·7%) compared with children of parents without such a history (19·6%). However, the risk was no greater, and sometimes less, if both parents had asthma-wheeze. This inconsistent trend may partly be a consequence of some rates being based on small numbers (Tables I and II). There was no consistent relationship between smoking and cough-phlegm in the parents and asthma in the children, although conclusions are limited once more by small numbers of children with asthma in some cells (Table III). By contrast, wheezing was consistently more common in children when their parents smoked or suffered from cough-phlegm (Table IV).

Asthma was reported more commonly in children of parents in the upper social than in children of lower social class parents (Table V). However, the rates were based on small numbers and the social class gradients were not wholly consistent at all ages; for example, the lowest incidence occurred in children up to the age of three years with parents from social class III. Wheezing was more common in children of lower social class parents. Area of residence had no influence on the incidence of asthma or wheezing.

As some of the family factors examined in the preceding tables were themselves interrelated, it was difficult to assess the influence of each individual factor upon the incidence of asthma or wheezing in the index children. To investigate these relationships, two logistic models were fitted to the data, one with the incidence of asthma in the index children as the outcome variable, and the other with the incidence of wheezing as the outcome variable. The independent variables included in both models were parental

TABLE II

INCIDENCE PER 100 INDEX CHILDREN OF ASTHMA* IN FIRST FIVE YEARS OF LIFE BY BRONCHITIS OR PNEUMONIA IN FIRST YEAR, AND BY PARENTAL ASTHMA-WHEEZE

		Parental Asthma-Wheeze			
		Neither	One	Both	Total
Bronchitis or pneumonia in the first year	No	2·3 (1333)	5·5 (421)	2·0 (50)	3·0 (1804)
	Yes	3·6 (138)	5·2 (77)	5·6 (18)	4·3 (233)
	Total	2·5 (1471)	5·4 (498)	2·9 (68)	3·2 (2037)†

Populations in parentheses.
*Asthma includes children who may have wheezed as well.
†Total excludes 96 index children with missing first, third, fourth and fifth year data and an additional 16 with missing initial data on parent pairs.

TABLE III

INCIDENCE PER 100 INDEX CHILDREN OF ASTHMA* IN FIRST FIVE YEARS BY PARENTAL COUGH–PHLEGM AND SMOKING HABITS

Parents Smoking‡	Parental Cough–Phlegm (During Period First to Fifth Year)			
	Neither Parent Ever Positive	Symptom Changed in One or Both Parents	One or Both Parents Always Positive	Total
Neither	2·9 (307)	1·5 (134)	— (4)	2·5 (445)
Habit changed in one or both	3·9 (279)	3·3 (299)	— (27)	3·5 (605)
One parent consistently smoking	3·3 (184)	2·2 (228)	5·8 (52)	3·0 (464)
Both smokers	1·1 (90)	4·0 (249)	8·0 (25)	3·6 (364)
Total	3·1 (860)	3·0 (910)	4·6 (108)	3·1 (1878)†

Populations in parentheses.
*Asthma includes children who may have wheezed as well.
†Total excludes 72 index children with missing third, fourth, and fifth year data and an additional 199 with missing first to fifth year data on parent pairs.
‡Considered over the full five years of the study.

TABLE IV

INCIDENCE PER 100 INDEX CHILDREN OF WHEEZING* IN FIRST FIVE YEARS BY PARENTAL COUGH–PHLEGM AND SMOKING HABITS

Parents Smoking	Parental Cough–Phlegm (During Period First to Fifth Year)			
	Neither Parent Ever Positive	Symptom Changed in One or Both Parents	One or Both Parents Always Positive	Total
Neither	16·6 (307)	27·6 (134)	25·0 (4)	20·0 (445)
Habit changed in one or both	13·3 (279)	26·1 (299)	29·6 (27)	20·3 (605)
One parent consistently smoking	11·4 (184)	28·1 (228)	23·1 (52)	20·9 (464)
Both smokers	21·1 (90)	27·3 (249)	36·0 (25)	26·4 (364)
Total	14·9 (860)	27·1 (910)	27·8 (108)	21·6 (1878)†

Populations in parentheses.
*Wheezing excludes children who had asthma.
†Total excludes 72 index children with missing third, fourth, and fifth year data and an additional 199 with missing first to fifth year data on parent pairs.

TABLE V

INCIDENCE PER 100 INDEX CHILDREN OF ASTHMA OR WHEEZING* DURING FIRST FIVE YEARS BY PARENTAL SOCIAL CLASS AT FIFTH YEAR

Illness in Children of Parents According to Social Class	Age in Years						Population
	By Age Three		By Age Four		By Age Five		
	Asthma	Wheezing	Asthma	Wheezing	Asthma	Wheezing	
Social class I and II	2·0	17·2	3·1	19·2	4·0	20·8	751
III	1·0	20·2	2·1	22·3	2·7	23·5	997
IV and V	1·4	21·2	1·8	24·5	2·5	27·3	278
Unknown	3·9	13·7	3·9	17·7	3·9	17·7	51
Total	1·5	19·1	2·5	21·3	3·2	22·9	2077†

*Asthma includes children who may have wheezed as well; wheezing excludes children who had asthma.
†Total excludes 72 index children with missing third, fourth, and fifth year data.

smoking, parental cough-phelgm, parental asthma-wheeze, number of siblings and their history of bronchitis or pneumonia and of asthma-wheeze, the sex of the index child, history of bronchitis or pneumonia in the first year of life, social class of the father when the child was aged five years, and area of residence.

In asthma, a history of parental asthma-wheeze was the only statistically significant factor. However, with wheezing, parental cough-phlegm and bronchitis or pneumonia during the first year of life of the child were both found to be statistically significant. The model was then refitted with these two factors alone as independent variables. The crude and adjusted incidence rates using this model are presented in Table VI, which shows that bronchitis or pneumonia during the first year of life had the greater effect upon the incidence of wheezing.

The influence of a history of asthma or wheezing on peak expiratory flow rate at five years was examined in those children for whom these data were available (Table VII). Peak expiratory flow rates were adjusted for differences in sitting height at age five years. Children with a history of both asthma and bronchitis or pneumonia had a significantly lower mean peak expiratory flow rate than those with a history of bronchitis or pneumonia alone; a difference of 17·4% ($P < 0·001$). Mean peak flow rates in children with a history of wheezing and bronchitis or pneumonia did not differ significantly from those

TABLE VI

CRUDE AND ADJUSTED INCIDENCE RATES PER 100 CHILDREN OF WHEEZING* FOR LEVELS OF EACH FACTOR WITH ESTIMATES OF THEIR EFFECTS

Factor and Level	Crude Incidence Rate	Adjusted Incidence Rate	Significance of the Factor in the Model		
			χ^2	df	P
Parental cough-phlegm					
Neither	17·7 (1263)	17·6	22·69	2	< 0·0005
One	27·2 (670)	26·3			
Both	34·6 (78)	30·3			
Bronchitis or pneumonia in the first year					
No	18·9 (1781)	18·8	43·63	1	< 0·0005
Yes	41·3 (230)	39·4			
Total	21·5 (2011)†	—	—	—	—

Populations in parentheses.
*Wheezing excludes children who had asthma.
†Total excludes 96 index children with missing first, third, fourth, and fifth year data and an additional 42 with missing initial or first year data on parent pairs.

TABLE VII

MEAN PEAK EXPIRATORY FLOW RATES IN CHILDREN AGED FIVE YEARS, BY HISTORY OF ASTHMA, WHEEZING, BRONCHITIS, OR PNEUMONIA

Symptom Group	Mean PEFR†	Population	Standard Error of the Mean	Significance of Difference Between Means of Groups With and Without Symptoms	
				t	P
Nil	151·5	292	1·5		
Asthma without bronchitis or pneumonia	—	3	—		
Wheezing without bronchitis or pneumonia	149·2	40	4·1	0·51	0·6< P <0·7
Asthma with bronchitis or pneumonia	118·6	10	8·2	3·95	P <0·001
Wheezing with bronchitis or pneumonia	140·3	33	4·5	2·34	0·01< P <0·02
Bronchitis or pneumonia only	143·5	76	3·0	2·38	0·01< P <0·02
Total	—	454†	—	—	—

*Asthma includes children who may have wheezed as well; wheezing excludes children who had asthma.
†Total excludes 4 index children with successful flow rate measurements at age five years but with missing first to fourth year data. The remaining 1691 children were not measured at age five years.
‡Litres/min, adjusted for sitting height at age five years.

with a history of bronchitis or pneumonia alone. The 40 children with a history of wheezing alone had peak flow rates similar to those of children without a history of asthma, wheezing, bronchitis, or pneumonia.

Discussion

Episodes of wheezing, 'whistling' or 'chestiness' not termed asthma by parents occurred much more commonly (in 21·7% of children) than asthma (3·2%) by the age of five years. Wheezing episodes were closely associated with bronchitis and pneumonia occurring during the first year. Wheezing was also associated with parental cough-phlegm and smoking as was bronchitis or pneumonia in the first year (Leeder *et al.*, 1976). This suggests that at least some of the environmental factors associated with bronchitis or pneumonia may also be important in the development of wheezing episodes in later childhood. Alternatively, genetic factors associated with bronchitis or pneumonia in the first year may also predispose to wheezing in later childhood. Damage to airways caused by bronchitis or pneumonia in early childhood may also make children more liable to wheeze subsequently.

While episodes of asthma in the first five years of life also showed an association with parental history of asthma-wheeze (as did episodes of wheezing not termed asthma) there is little relationship between asthma in the first five years and other family, social, or environmental factors.

In this study, the parents' account of asthma and wheezing in their children was used to define these illnesses. Despite the uncertainties implicit in using parentally reported data, asthma and wheezing were, as discussed, associated with different family factors. Also, the effects of asthma and wheezing on peak expiratory flow rates at the age of five years were different. Children with a history of asthma had lower peak expiratory flow rates at the age of five than the children with a history of wheezing alone. In asthma adequate treatment can often reverse much of the airways obstruction. The low peak expiratory flow rate at the age of five we found in children with a history of asthma may indicate the need for vigorous bronchodilator therapy. Alternatively, this deficit may reflect irreversible airways obstruction (Cade and Pain, 1973). More concerted treatment in the first five years of life may have prevented its development. Whatever the potential for the reversal of the decreased peak expiratory flow rate found in children with a history of asthma, it appears that the parents' account differentiated between important and unimportant illness, according to whether they termed it asthma or wheezing.

The incidence rates for asthma and wheezing obtained in studies of children clearly depend upon how these two conditions are defined and the populations in which surveys are conducted. In a study of Kent schoolchildren, using similar methods to those used in this study, Hamman, Halil, and Holland (1975), found comparable rates of asthma by the age of 11 years to those that we found by the age of five years. Similar incidence rates for asthma were found in a study of schoolchildren in Birmingham (Smith, 1961).

Asthma was reported more commonly in children of upper class parents, whereas the reverse was true of wheezing. These social class trends could reflect differences in reporting behaviour among parents of different social classes. More parents in social classes I and II may report asthma rather than wheezing episodes when confronted with essentially the same illness in their children. Alternatively, there could be a real difference in the social class distribution of asthma. Hamman *et al.* (1975) found a similar trend to the one described in this paper while Dawson *et al.* (1969) in a study in Aberdeen, Scotland, found a social class trend in asthma incidence contrary to ours.

The incidence of wheezing may prove to be more modifiable than that of asthma by changing environmental factors, as attacks of wheezing were closely associated with bronchitis and pneumonia during the first year of life. Bronchitis and pneumonia in the first year have, in turn, been shown to be associated with such factors as parental smoking habits (Colley, Holland, and Corkhill, 1974). Thus, efforts to prevent bronchitis and pneumonia during the first year of life may also reduce the incidence of wheezing and of other chest illnesses in later childhood.

The syndromes of lower respiratory illness in childhood remain poorly defined and it is clear that the precision of diagnosis of these illnesses requires improvement before more effective treatment can be given to the children who require it. On the basis of the epidemiological evidence presented here, it seems most unlikely that all forms of the more frequent lower respiratory illness in childhood are simply manifestations of a single common disorder. There may well be common features in aetiology and natural history between conditions such as asthma and bronchitis, but this is not a good reason to use these terms interchangeably. This is especially important when strategies for prevention of one or other condition are being considered.

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