PRACTICE OBSERVED

Practice Research

Outcome of respiratory illness occurring in the first year of life

C J WATKINS, Y SITTAMPALAM, J BARTHOLOMEW

Abstract

This paper describes the outcome of respiratory illness presented by a birth cohort of infants in the first year of life who were born to mothers in two inner London group general practices in terms of the ventilatory capacity measured at their fifth birthday. A history of two or more episodes of "lower" respiratory illness in the first year of life was associated with a significant reduction in peak expiratory flow when compared with those who had no such history. Boys had significantly higher peak flow rates than girls, whose parents were in manual occupations had significantly lower peak flow rates than those whose parents were in non-manual occupations. There was a significant interaction between sex and social class.

Introduction

This paper is the sequel to the paper that described the pattern of respiratory illness in children in the first year of life presenting to general practitioners and the influence of seasonal factors and social and family health variables. The study described in this second paper examined the relation of the different patterns of illness and the influence of family and social variables to the outcome of respiratory disease by following up the birth cohort to age five years.

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The aim was to find a way to identify groups of children at risk of subsequent chronic lung disease on whom preventive efforts could be concentrated.

Methods

The methods were described in detail in the preceding paper.¹ The study population consisted of children who were born between 1 June 1973 and 31 May 1978 to mothers who were registered with two adjacent group general practices that provide care for a total of 17 000 patients in the inner London Borough of Lambeth. Throughout the first year of each child's life consultations with the general practitioner were recorded on structured medical records. Two types of respiratory episodes were defined as follows: (i) "upper" respiratory illness: an episode in which no recordings of adventitious lung sounds were made at any consultation; (ii) "lower" respiratory illness: an episode in which at one or more consultations adventitious lung sounds were recorded.

At the child's first birthday a questionnaire was administered to the mother by a trained interviewer. Information was thus obtained about the child's health during the first year of life, the health of the mother and father, and other social variables that were thought to be important in determining the frequency of respiratory illness. At the age of 5 each child was visited by a fieldworker who measured the child's height using a portable stadiometer and administered a further questionnaire to the mother concerning several relevant social and family variables. Peak expiratory flow was measured using an adult Wright Peak Expiratory Flow Meter. Five readings were taken in all, and the mean of the last three readings was used for analysis. One peak flow meter was used throughout the study and was calibrated by the London School of Hygiene and Tropical Medicine every six months. Interviews were carried out and peak flows measured during two periods of the year (April-May and August-September) to avoid the times of year when respiratory infection and hay fever most often occur. Most readings were done in the late afternoon, thus avoiding the times of day when patients with asthma have low readings of peak expiratory flow. Tests were delayed for two weeks after an acute respiratory illness. Each child was examined in the period of testing when he or she was closest to the age of 5. How well each child understood how to use the peak flow meter was assessed by the fieldworker and recorded on the questionnaire.

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The data were analysed using the regression techniques of the statistical package GLIM. These techniques allow the effects of several factors to be examined simultaneously.

Results

Four hundred and four children with complete consultation and first year questionnaire data were available for study. Of these, 19 (25%) could not be contacted at the age of 5, either because they were not traceable through the Central Register of the National Health Service or because they had moved too far away for the fieldworker to visit. There was one death due to the inhalation of vomit at the age of 4½. Thirty-two children were judged by the fieldworker not to have understood the instructions on the use of the peak flow meter, four children were unable to use the peak flow meter, and two refused, leaving 266 children with a complete set of consultation data, peak expiratory flow data, and data from maternal questionnaires at the child's

TABLE 1—Characteristics of children who provided data for analysis

Frequency of respiratory illness	No. % available for follow up (n = 404)	No. % lost to follow up (n = 102)	No. % who failed to provide valid peak expiratory flow readings (n = 36)	No. % who provided complete data for analysis (n = 266)
Lower respiratory illness twice or more	49 (22.1)	11 (10.8)	8 (22.2)	30 (31.3)
Upper respiratory illness twice or more	204 (50.4)	51 (50.0)	12 (33.3)	141 (53.6)
Father's occupation, manual	228 (56.4)	54 (54.9)	20 (55.6)	150 (56.4)
Shower's bedroom with an adult or a child	300 (74.3)	76 (74.5)	29 (80.6)	195 (73.3)
No. of children under 5 in household	252 (62.3)	71 (69.6)	21 (58.3)	158 (59.3)
No. of children with a parent with a productive morning cough	140 (34.6)	31 (32.4)	14 (40.0)	93 (35.0)
No. of children with a parent reporting asthma or wheeze	128 (31.7)	34 (34.3)	14 (40.0)	79 (30.0)
No. of siblings of school age	141 (34.9)	28 (28.2)	17 (47.2)	102 (38.4)
No. of siblings ever lost	254 (62.9)	62 (60.8)	21 (58.3)	162 (61.2)
Can be used for cooking	331 (82.4)	81 (83.3)	31 (86.1)	217 (81.6)

PEF = peak expiratory flow.

TABLE 2—Relation between peak expiratory flow at age 5 years and the experience of respiratory illness in a birth cohort of 266 children

Experience of respiratory illness	No. of children	Mean (SD) peak expiratory flow rate (l/min)	Significance level
None	55	161.8 (1.99)	—
Upper respiratory illness only	114	162.2 (2.20)	p > 0.10
Lower respiratory illness only	67	162.9 (2.32)	p > 0.10
Lower respiratory illness more than once	30	151.2 (4.12)	p < 0.05

*Corrected for child's standing height.

TABLE 3—Relation between peak expiratory flow at age 5 years and health and personal variables in a birth cohort of 266 children

Variable	No.	Mean (SD) peak expiratory flow rate (l/min)	Significance level
Sex			
Male	141	165.2 (2.50)	
Female	125	157.8 (3.64)	p < 0.05
Father's occupation*			
Non-manual	114	165.7 (3.35)	
Manual	152	158.4 (3.48)	p < 0.05
Shower's bedroom with an adult or another child			
No	70	164.1 (3.54)	
Yes	196	158.3 (3.81)	p < 0.05
Parent reports morning coughing*			
No	96	160.1 (3.47)	
Yes	170	161.7 (3.58)	p < 0.05
Personal cough phlegm*			
No	140	162.1 (3.28)	
Yes	126	159.0 (3.60)	p < 0.05

*Excludes 11 individuals on whom no information about the child's father was available.

*Corrected for child's standing height.

first and fifth birthdays. Table 1 shows the characteristics of those who provided follow up data together with those who were lost to follow up. Significantly more girls than boys failed to understand the instructions on the use of the peak flow meter, but in other respects the characteristics of the group that provided complete follow up data were comparable with those who were eligible for follow up with regard to frequency of respiratory illness and the main family and social variables being considered.

The aim of this study was to identify the factors that appeared to affect peak expiratory flow adversely. Peak expiratory flow varied according to the child's height and age. The child's height was not, however, related to the frequency of episodes of lower respiratory illness. By adjusting the peak expiratory flows for the child's height, variation of peak flows according to the child's age was also taken into account. In tables II-IV this adjustment was made.

Frequency and type of respiratory illness.—Table II shows the frequency and type of respiratory illness related to peak expiratory flow at age 5. Children who had a history of upper respiratory illness only had a mean peak expiratory flow rate that was not significantly different from those who had no respiratory illness on one occasion only suffered no impairment of peak expiratory flow compared with those who had never consulted for respiratory illness. Those with a history of two or more episodes of lower respiratory illness had a mean peak expiratory flow 10 l/min lower than those with no consultations for respiratory illness (p < 0.05). Neither the age at which the child presented with lower respiratory illness nor the season of birth was associated with a significantly lower peak expiratory flow.

Sex and social and environmental factors.—Apart from the child's experience of respiratory illness we looked at other factors which might explain the variance of peak expiratory flow in our cohort. Table III shows the relation of each of these main factors to peak expiratory flow, corrected only for the child's height. Boys had a higher mean peak expiratory flow than girls (p < 0.05) and the children whose fathers were in non-manual occupations had a higher mean peak expiratory flow than those whose fathers were in manual occupations (p < 0.05). Those who shared a bedroom either with another child or with an adult had a lower mean peak expiratory flow than those who had a bedroom to their own (p < 0.05). There was no association between children's peak expiratory flow and parental smoking habits or respiratory symptoms, the presence of children of school age in the family, or whether the child had been breast fed. To test the independent effects of these personal and family factors on peak expiratory flow at age 5, a multiple regression analysis was performed using the variables listed in table 1. The only factors that are significantly related to peak expiratory flow at the age of 5 are sex and social class. Table IV shows the relation between peak expiratory flow by sex, occupation of parent, and frequency of episodes of lower respiratory illness experience. Boys whose fathers are in non-manual occupations have a higher level of peak expiratory flow with increasing frequency of experience of lower respiratory illness, whereas the reverse is true of boys whose fathers are in manual occupations and girls of either social class group.

Discussion

This study is the first to relate patterns and types of respiratory illness in children who presented to the general practitioner in the first year of life to objective measures of respiratory function at the age of 5. It was also possible to compare the prognostic importance of the experience of lower respiratory illness in the first year of life

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TABLE IV—Relation between peak expiratory flow rate and parent's occupation, sex, and frequency of lower respiratory illness

Parent's occupation	No lower respiratory illness		Lower respiratory illness once only		Two or more episodes of lower respiratory illness		Total	
	Mean (SD) PEF*	No.	Mean (SD) PEF*	No.	Mean (SD) PEF*	No.	Mean (SD) PEF*	No.
Non-manual	169.7 (3.15)	15	163.4 (3.07)	13	159.4 (3.9)	3	174.4 (4.03)	11
Manual	158.2 (3.85)	41	153.8 (3.27)	10	150.0	1	157.1 (3.38)	52
Boys	161.2 (2.62)	21	162.7 (2.99)	21	169.6 (3.91)	13	159.7 (2.27)	79
Girls	162.1 (2.45)	40	150.4 (3.01)	20	149.4 (3.96)	11	158.1 (2.30)	71
Total	160.0 (3.31)	161	161.0 (3.21)	44	158.8 (3.79)	24	161.7 (3.44)	214

*Corrected for child's standing height only.

with other variables that are known to be associated with respiratory morbidity.

In a previous study of similar design the relative influence of several personal and family factors on peak expiratory flow at age 5 was estimated.¹ Information was collected from mothers about their recall of their children's experience of respiratory illness for each of the first four years of life. Children with a history of bronchitis, pneumonia, or asthma in the early years of life had lower peak expiratory flows by the time they reached age 5. The earlier the occurrence of these illnesses, the greater the subsequent effect on ventilatory function. Recurrent illnesses had a greater influence than single episodes, and recall by the mother that her child had suffered both asthma and bronchitis placed her child in the group with the worst peak expiratory flow.

The results of our study, based on consultation data collected during the first year of life only, show that with the exception of boys whose fathers are in non-manual occupations the children who presented with two or more episodes of lower respiratory illness have an appreciably impaired peak expiratory flow compared with those with no such history.

The high peak flow values of boys whose fathers are in non-manual occupations are difficult to explain. These boys have significantly higher peak expiratory flows than the remainder of the cohort whatever their experience of respiratory illness. This has not been reported before from similar community surveys and may possibly be explained by the small numbers in this survey and the consequent sampling error. We have no other convincing explanation to offer.

With the exception of boys whose fathers are in non-manual occupations, this study confirms an association between recurrent lower respiratory illness in infancy and a significantly diminished peak expiratory flow at the age of 5. The question remains open as to what is the nature of this relation. One suggestion is that these illnesses are due to infections which result in permanent damage to the small airways or lung parenchyma. Support for a hypothesis of infection comes from the winter peak of lower respiratory illness

corresponding with the time of year when there is a high prevalence of respiratory virus infection. Another hypothesis is that lower respiratory illness in infancy and diminished peak expiratory flow at the age of 5 are both manifestations of the same physiological defect in the lungs of a particular group of children, some of whom in later childhood are considered to have asthma. These explanations are, of course, not incompatible with one another, and the physiological defect—whatever it may be—may render the child more susceptible to respiratory infection or the effect of the infections may be more obvious to the mother when they occur.

Clearly, the question of a physiological defect in these children needs to be examined further. The results of this study suggest a way to identify a group of children who are at an increased risk of having subsequent lower ventilatory function from the general practice records. Further study of this group might yield more information on the mechanisms concerned.

We thank the patients and the doctors of the Lambeth Road Group Practice and the Lambeth Road Group Practice for providing the data for this study, to Miss Mary Evans and Mr George Hamilton for their help in data collection and analysis, Professor W W Holland, Professor D C Morrell, and Professor J Cameron for their expert guidance on the design of this study, and Mrs Carmel Stephenson, who patiently typed the many drafts of this paper. The study was supported in part by a grant from the Department of Health and Social Security.

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would obviously not be by any means sufficient. It is to be hoped that the local authorities have succeeded in promoting vaccination and revaccination among the young, in isolating, as far as possible, the infected persons, in carrying out or securing effective measures of disinfection, and in enforcing the provisions of Section 126 of the Public Health Act, 1875, whenever necessary to prevent the exposure of infected persons, articles, or things. A great deal, however, depends in such a case on the tact, good judgment, and watchfulness of the local sanitary officials, and on their influence on the wardens. In connection with this subject, it should not be forgotten that by Section 9 of the Housing of the Working Classes Act, 1885, a tenement or van used for human habitation which is in such a state as to be a nuisance or injurious to health, or which is so overcrowded as to be injurious to the health of the inmates, whether or not members of the same family, shall be deemed to be a nuisance within the meaning of Section 91 of the Public Health Act, 1875, and further, that when any person duly authorised by a sanitary authority or by a justice of the peace has reasonable cause to suppose that there is in any such tenement or van any person suffering from a dangerous infectious disorder, he may examine the same in order to ascertain the facts. *Br Med J* 1986;293:167.

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Doctors as nutrition educators? Part I

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How well qualified are you to educate your patients about nutrition? Try this quiz (the first of four quizzes) on your nutritional knowledge.

- How dangerous is it for your patients to eat foods high in ADG?
- What is the minimum recommended fluid intake a day for an adult?
- What is the National Advisory Committee on Nutrition Education recommendation for total fat content of the diet for the general population?
- Which contains the most energy value (calories): a can of Carlsberg beer or a can of Diet Pepsi?
- Give three reasons why infants should not be weaned on goat's milk.
- Which vitamin is likely to be deficient in the diet of the housebound elderly person?
- Which food is a good source of protein, B vitamins, and iron, is low in cholesterol, and is relatively cheap?
- Name three sources of iron for non-meat eaters.
- Sardines are a good source of riboflavin, biotin, and iron. True or false?
- Which of these cereals has the most effective fibre content?
 - Puffed Wheat
 - Corn Flakes
 - Rice Crispies
 - All Bran
- Which sugar has the highest energy value (calories)?
 - sucrose
 - dextrose monohydrate
 - fructose
 - maltodextrin
 - lactose
- Which of these margarines is high in polyunsaturated fatty acids?
 - Blueband
 - Krusa
 - Flora
 - Summer Counts
 - Vitalite
 - Sola
 - Goya
 - Outline
 - Clover
 - Stork SB

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See below for the answers.

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100 YEARS AGO

The Secretary of State for War, prompted by a desire to promote the health of the workmen in the Government factories, as well as the good of the service, has issued an order that all overtime work at Woolwich Arsenal and other Government factories is to be discontinued, and the workmen, who have been for the most part employed four extra hours daily for the past twelve months, return to the ordinary average of nine hours a day. The Secretary of State for War speaks wisely when he says that he does not think that men can work continuously thirteen hours a day in confined workshops without suffering ill consequences, and that when they are fatigued by long hours, they are unlikely to work so well as they can within reasonable restrictions, even with the stimulus of increased pay at the rate of time and a half. This is an example which many other large employers of labour would do well to follow. (*British Medical Journal* 1886;1:687.)

Foot-ball players, when the dangers attendant upon that peculiar form of amusement are pointed out to them, are in the habit of maintaining that serious accidents ought properly to be considered rare when allowance is made for the very general prevalence of the game on a matter of fact, only the most severe accidents are ever reported in the daily press. If a player is killed outright, or if he dies so shortly after the receipt of the injury as to necessitate an inquiry before a coroner, then a report appears, and, in a good many instances, some record of cases in which fracture of the leg or serious contusion of the brain occurs, may be found. Newspapers generally have a paragraph on Monday, giving particulars of a few of the accidents of the previous Saturday. This week, for example, two accidents are reported, both cases resulting in fracture of the leg. But as long as a man can walk off the ground, the injuries he may have received are not, as a rule, mentioned. Such trifles as a fractured collar-bone, or a dislocated shoulder, are apparently of such extremely common occurrence that the writers who contribute descriptions of foot-ball matches to local or sporting papers do not consider them worthy of mention. Another argument used by those who seek to defend this obsolete "sport" is that these accidents only occur in chance

matches between scratch teams, and are due to some of the players not knowing the rules. But one of the accidents which occurred on Saturday happened during a county match between Sussex and Hampshire and Dorset. Medical students have, in the past, shown a curious love for this rough pastime, but there are not wanting signs that its popularity is declining among the better class of students, and that its place will soon be taken by more intelligent and manly ways of spending Saturday afternoon. (*British Medical Journal* 1886;1:831.)

Doctors as nutrition educators? Part I

Answers to quiz above

1. How dangerous is it for your patients to eat foods high in ADG? 2. What is the minimum recommended fluid intake a day for an adult? 3. What is the National Advisory Committee on Nutrition Education recommendation for total fat content of the diet for the general population? 4. Which contains the most energy value (calories): a can of Carlsberg beer or a can of Diet Pepsi? 5. Give three reasons why infants should not be weaned on goat's milk. 6. Which vitamin is likely to be deficient in the diet of the housebound elderly person? 7. Which food is a good source of protein, B vitamins, and iron, is low in cholesterol, and is relatively cheap? 8. Name three sources of iron for non-meat eaters. 9. Sardines are a good source of riboflavin, biotin, and iron. True or false? 10. Which of these cereals has the most effective fibre content? 11. Which sugar has the highest energy value (calories)? 12. Which of these margarines is high in polyunsaturated fatty acids?