PAPERS AND ORIGINALS

Climate and Chest Disorders in Schoolchildren*

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Summary

A survey of the respiratory disorders in schoolchildren from rural areas showed no significant differences between the United Kingdom and Australia and New Zealand in loss of time from school owing to chest illness. Contrary to expectations the warmer the region the greater the prevalence of bronchitis, asthma, and hay fever. These results should encourage a critical appraisal of the respiratory benefits of warmer climates, and also suggest that the English climate should prove to be no more than a minor barrier to any future reduction of respiratory mortality in the U.K.

Introduction

As climate may contribute to the prevalence of chronic bronchitis in the temperate zones, the potential influence on chest disease has been studied in rural schoolchildren in England, Scotland, Australia, and New Zealand so as to avoid the problems of air pollution, urban overcrowding, and smoking. In view of the common ethnic origins of the populations any respiratory questionnaire was likely to be interpreted similarly in each of these regions.

Methods

Information was collected concerning 16,408 schoolchildren aged 6-15 years (Australia and New Zealand 12,934; United Kingdom 3,474) during the summer months of school between 1967 and 1969. Questionnaires were sent home from school with the children to be filled in by parents and returned to the school for collection by the local doctor. The response to the questionnaire constituted a rate of 78% for the children

in the Australian and New Zealand schools, with no variation in response with climate. There was a response rate to the questionnaire in the U.K. of 82%, where accurate information was obtained about the available number of children that were sampled. Despite the unknown response rates of a portion of the U.K. sample (17% of the entire sample) it was included, as the results from areas with known and unknown response rates were consistent with each other.

Samples were taken from the following areas. England: Pateley Bridge, Buxton, Tewkesbury, Sedgefield, Ramsbury, Saltash, Peaslake, Penshurst, Heathfield, Buckfastleigh. Scotland: Perthshire, Cupar, Fife, Ayrshire, Inverbervie. Queensland: Charleville, Kingaroy. New South Wales: Bourke. Victoria: Upper Yarra Valley. Tasmania: Newtown, Ogilvie. South Australia: Mt. Gambier, Renmark, Hamley Bridge, Woodside, Oakbank, Mallala. Western Australia: Northam, Beverley, Busselton, Narrogin, Albany. New Zealand, Southland. All schools were situated in rural areas with the exception of the Hobart suburban schools of Newtown and Ogilvie.

QUESTIONNAIRE

The questions asked on the form were: Has your child ever had any of the following conditions: Did he/she have infantile (baby) eczema?; Has he/she ever had eczema in the creases of the elbows, wrists, or knees?; Does he/she get attacks of hay fever (that is, sneezing, running or blocked nose, sometimes with itchy nose and eyes)?; Has he/she ever suffered from attacks of asthma (or wheezy breathing)?; Does he/she suffer from attacks of bronchitis (or cough with phlegm)?; If yes, at what age did these attacks of bronchitis begin?; On a rough average, how frequently do these attacks occur?; Do these attacks tend to be more frequent or more severe at any particular time of the year?; What are the bad months? (Bracketed were January-February, March-April, and so on); On the average in the last two years, how much time did the child lose from school each year because of chest illness?

Information was obtained about each school's latitude, longitude, average maximum and minimum summer and winter temperatures, and average summer and winter rainfalls. Methods of investigation included a weighted analysis to examine effects of variation in sampling size or distribution of age in relation to geographical location.

*Based on a paper presented at the annual meeting of the Thoracic Society of Australia on 16 May 1972.

Results

Prevalence of Disorders.—The prevalence of bronchitis decreased with increasing age compared with hay fever, which increased with age, and asthma, which showed no noticeable trends with age (Table I). More boys than girls were reported to have bronchitis ($P < 0.001$), asthma ($P < 0.001$), and hay fever ($P < 0.001$), with no significant differences according to sex concerning either eczema or infantile eczema.

Climatic Factors and Disorders.—There were no significant associations between latitude or climatic conditions and children who had lost one week or more from school owing to chest illness in the preceding two years. The relation between latitude, climatic factors, and the prevalence of bronchitis, asthma, and hay fever is shown in Table II. With girls, the higher the average maximum and minimum summer and winter temperatures and the lower the latitude and average summer rainfall the greater the prevalence of bronchitis, asthma, and hay fever (12 out of 18 correlations were significant at levels of $P < 0.001$ or greater). In addition, the lower the winter rainfall the higher the prevalence of hay fever ($P < 0.005$). With boys, identical but less distinct trends were seen concerning temperatures, latitude, and summer rainfall, with 12 out of 18 correlations being significant at levels of $P < 0.05$ or greater. There were no correlations of significance regarding average winter rainfall.

Analysis of Individual Hemispheres.—Comparisons with the results from the combined hemispheres showed identical trends in the U.K. and in Australia and New Zealand, particularly in girls, although fewer associations reached levels of statistical significance (Table II). There were few associations of significance between eczema and climate and the results have not been included in Table II. For boys in Australia and New

Zealand, however, the higher the summer and winter temperatures the lower the prevalence of both infantile eczema and eczema. No other consistent trends were apparent concerning the relation between the eczemas and climate, with only four of the remaining 76 correlations reaching levels of significance.

Interrelation of Disorders.—There were significant associations between the prevalence of bronchitis and asthma in boys ($P < 0.001$) and in girls ($P < 0.001$); between asthma and hay fever in boys ($P < 0.01$); between hay fever and infantile eczema in boys ($P < 0.05$) and in girls ($P < 0.05$); and between hay fever and eczema in girls ($P < 0.01$).

Discussion

This survey showed no disadvantages in the more temperate zones regarding schoolchildren and chest illnesses, findings which were somewhat unexpected and thus demanding particular scrutiny of the methods. Firstly, colder climates might make people less acquiescent, and therefore they would tend to answer "no" to any type of question. This suggestion was not supported by the tendency for higher proportions of the children in the U.K. compared with those in Australia to have a history of infantile eczema and of eczema (Table I). Another possibility was that rural people living in cold climates might interpret the English language differently from those living in warmer rural zones. Rural people in Australia, however, are predominantly of Anglo-Saxon origin, while it is the urban areas that attract proportionally more of the non-Anglo-Saxon migrants. Similarly in the U.K. the concentration of Commonwealth migrants occurs in the urban and industrial areas. In regard to the unknown response rates for 17% of the sample

TABLE I—Prevalence of Bronchitis, Asthma, Hay Fever, Eczema, and Infantile Eczema According to Age and Sex for 16,408 Rural Schoolchildren in Australia and New Zealand (Aust.) and the U.K.

Age (Years)	Total		Bronchitis		Asthma		Hay Fever		Eczema		Infantile Eczema	
	Aust.	U.K.	Aust. (%)	U.K. (%)	Aust. (%)	U.K. (%)	Aust. (%)	U.K. (%)	Aust. (%)	U.K. (%)	Aust. (%)	U.K. (%)
Boys:												
6-7	1,072	354	224 (21)	47 (13)	140 (13)	39 (11)	127 (12)	37 (10)	72 (7)	24 (7)	85 (8)	33 (9)
8-9	1,344	360	220 (16)	40 (11)	164 (12)	27 (8)	192 (14)	48 (13)	71 (5)	20 (6)	84 (6)	32 (9)
10-11	1,376	384	176 (13)	43 (11)	152 (11)	37 (10)	212 (15)	55 (14)	70 (5)	27 (7)	78 (6)	34 (9)
12-13	1,642	351	190 (12)	34 (10)	191 (12)	28 (8)	262 (16)	48 (14)	90 (5)	15 (4)	95 (6)	14 (4)
14-15	984	306	108 (11)	24 (8)	124 (13)	21 (7)	178 (18)	34 (11)	49 (5)	19 (6)	73 (7)	19 (6)
Total	6,418	1,755	918 (14)	188 (11)	771 (12)	152 (9)	971 (15)	222 (13)	352 (5)	105 (6)	415 (6)	132 (8)
Girls:												
6-7	1,118	402	201 (18)	34 (8)	100 (9)	16 (4)	121 (11)	21 (5)	87 (8)	34 (8)	89 (8)	29 (7)
8-9	1,328	343	184 (14)	24 (7)	100 (8)	13 (4)	169 (13)	22 (6)	71 (5)	21 (6)	62 (5)	20 (6)
10-11	1,395	338	164 (12)	17 (5)	117 (8)	14 (4)	206 (15)	29 (9)	96 (7)	25 (7)	90 (6)	26 (8)
12-13	1,650	294	182 (11)	20 (7)	130 (8)	21 (7)	262 (16)	30 (10)	88 (5)	15 (5)	94 (6)	10 (3)
14-15	1,025	342	75 (7)	28 (8)	100 (10)	19 (6)	183 (18)	45 (13)	54 (5)	20 (6)	50 (5)	22 (6)
Total	6,516	1,719	806 (12)	123 (7)	547 (8)	83 (5)	941 (14)	147 (9)	396 (6)	115 (7)	385 (6)	107 (6)

TABLE II—Correlation Coefficients between Climate and Prevalence of Bronchitis, Asthma, and Hay Fever for 16,408 Rural Schoolchildren from 18 Schools in Australia and New Zealand (Aust.) and 14 Schools in the U.K.

Disorder		Latitude	Average Summer Maximum Temperature	Average Summer Minimum Temperature	Average Winter Maximum Temperature	Average Winter Minimum Temperature	Average Summer Rainfall	Average Winter Rainfall
Boys								
Bronchitis ..	Aust.	-0.35	0.33	0.31	0.25	0.17	-0.11	-0.02
	U.K.	-0.40	0.47	0.41	0.47	0.42	-0.40	-0.10
	Combined	-0.46*	0.44†	0.38†	0.43†	0.42†	-0.27	-0.03
Asthma ..	Aust.	-0.17	0.29	0.30	0.25	0.25	-0.15	-0.09
	U.K.	-0.45	0.45	0.58†	0.56†	0.52	-0.53	-0.19
	Combined	-0.52*	0.50*	0.43†	0.54*	0.56*	-0.35	-0.09
Hay Fever ..	Aust.	0.26	0.07	0.00	0.19	0.21	-0.58†	-0.31
	U.K.	-0.51	0.63†	0.50	0.66*	0.45	-0.37	-0.04
	Combined	-0.16	0.25	0.15	0.17	0.36†	-0.56*	-0.22
Girls								
Bronchitis ..	Aust.	-0.27	0.36	0.20	0.16	0.35	-0.44	0.09
	U.K.	-0.57†	0.69*	0.60†	0.56†	0.46	-0.30	0.06
	Combined	-0.60†	0.58†	0.39†	0.54*	0.63†	-0.51*	0.08
Asthma ..	Aust.	-0.53†	0.48	0.52†	0.65*	0.58†	-0.22	0.03
	U.K.	-0.10	0.54*	0.13	0.27	0.04	-0.38	-0.22
	Combined	-0.67†	0.64†	0.57†	0.73†	0.67†	-0.39†	0.00
Hay Fever ..	Aust.	-0.09	0.31	0.20	0.07	-0.07	-0.23	-0.50
	U.K.	-0.59†	0.65†	0.46	0.60†	0.43	-0.43	-0.04
	Combined	-0.47*	0.52*	0.37†	0.45†	0.39†	-0.39†	-0.36†

* $P < 0.05$.

† $P < 0.01$.

‡ $P < 0.001$.

(a result of inadequate Australian-U.K. communications by the investigator) this was unlikely to have been a major source of bias, as the comparisons between areas with known and unknown response rates in the U.K. showed both sections of data to be comparable with each other. With regard to the problem of chest illness causing absence from school during the week of the survey, this likelihood was substantially lessened by circulating the questionnaires during the summer months when the prevalence of both bronchitis and asthma were at their lowest levels. Significant bias could have occurred through smoking by some of the children, but this hardly begins in children before the age of 11 years (Todd, 1969), and the U.K.-Australian differences in the prevalence of bronchitis were most prominent before this age. The accurate differentiation between bronchitis and asthma is frequently difficult when using only a questionnaire as the method of study. Fortunately for the purposes of this report both disorders showed very similar relations with climatic factors.

These results suggest that children develop or receive some protection from any disadvantages that may be inherent in the more temperate zones of rural areas. Perhaps mothers in the warmer climates do not provide sufficient clothing for their children during the cold weather. Another potential disadvantage of warm climates is the dust (or pollens) in farming areas during the summer months, particularly in the wind-blown areas in the north of Australia. The finding that children had fewer respiratory symptoms when from areas with higher summer rainfalls could be related to the better summer pastures and consequently less dust in the environment.

Despite the higher respiratory death rates during childhood in England and Wales compared with the Netherlands and Scandinavia (Reid, 1969), the data suggest that rural people should hesitate before migrating to warmer climates—for example, Australia—in the hope of benefiting the chest illnesses in their children.

In the absence of any major bias incurred by the methods of study, the present report supports the hypothesis that the predominant factors in chronic respiratory disease are environmental and preventable, rather than climatic ones from which

there can be inadequate protection. Although climate could be important when associated with other respiratory hazards, the reasons for geographical differences in respiratory disease should usually be found in the factors already incriminated, such as smoking, dust, micro-organisms, pollution, and social conditions (Colley and Reid, 1970; Colley, 1971).

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Postoperative Depression of Tumour-directed Cell-mediated Immunity in Patients with Malignant Disease

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Summary

Leucocytes from 46 melanoma patients, 45 breast carcinoma patients, and 95 control donors were tested by the leucocyte migration test against the supernatants of homogenates of malignant melanomas, breast carcinomas, simple breast tumours, and breasts showing simple cystic disease. By comparison with controls inhibition of migration occurred significantly more frequently when tumour patients' leucocytes were exposed to extracts of histogenetically similar tumours.

Cell-mediated immunity to tumour-associated antigens was measured in 12 patients with breast carcinoma and 12 with malignant melanoma immediately before surgical operation and in the postoperative period. All patients tested before operation showed significant inhibition of migration on contact with extracts of histogenetically similar tumours. Postoperatively the degree of leucocyte migration inhibition was reduced in all patients with melanoma and breast carcinoma. Significant inhibition of leucocyte migration returned in most patients 6-22 days after operation.

Introduction

Metastasis formation remains a major problem in the management of patients with malignant disease. Despite the high frequency of spread from the primary site only a minority of the malignant cells which reach the blood stream or lymphatics give rise to secondary tumours (Madden and Karpas, 1967). There

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