Brit. J. prev. soc. Med. (1969), **23**, 77–84

RESPIRATORY SYMPTOMS AND VENTILATORY FUNCTION: A FAMILY STUDY

BY

W. W. HOLLAND, M.D., B.Sc.
Professor

H. S. KASAP, A.I.S.
Lecturer

Department of Clinical Epidemiology and Social Medicine, St. Thomas's Hospital Medical School, London, S.E.1

J. R. T. COLLEY, M.B., B.S., B.Sc.
Senior Lecturer

Department of Medical Statistics and Epidemiology, London School of Hygiene and Tropical Medicine, London, W.C.1

AND

W. CORMACK, M.B., Ch.B., D.P.H.
Medical Officer of Health

London Borough of Harrow, Health, Welfare, and Children's Department

The family study described in this paper was designed primarily to assess the influence of familial, social, and environmental factors upon the development of respiratory disease in children in the first five years of life.

The purpose of this paper is to describe the effect of age, sex, smoking habit, area of residence, social class, and domestic environment on respiratory symptoms and ventilatory function in the parents and siblings. It should be emphasized that this group of parents essentially consists of young people; this is in contrast with most other studies of respiratory disease that have concentrated upon middle-aged adults in specific occupational groups. Preliminary observations of this study were reported by Colley and Holland (1967).

Description of Area

The study was made in the borough of Harrow, a suburb in north-west London. Two areas within the borough were chosen to provide a range of environmental conditions that might be related to respiratory disease, such as air pollution and housing standards. These two areas are referred to as Area 1 and Area 2. Each consists of three electoral wards; both are residential and consist, in the main, of private houses with small gardens and a few small blocks of flats. The two areas differ in that Area 1 has a higher density of persons per acre and persons per room (Table I).

Measurements of smoke and sulphur dioxide are made at a single site in each area. These measurements are made with the standard apparatus and techniques employed in the National Survey of Smoke and Sulphur Dioxide. The monthly mean smoke and sulphur dioxide readings, in micrograms per cubic metre of air, are given in Table II. There were a number of absent values in the data, but estimates of the mean winter levels in 1962/63 show that site No. 4 in Area 2 had higher smoke and sulphur dioxide levels than site No. 3, but by winter 1963/64 and 1964/65 the levels at both sites were very similar.

TABLE I

TOTAL POPULATION, PERSONS PER ACRE, AND PERSONS PER ROOM, BY WARD (1961 Census)

Ward	Total Population	Persons per Acre	Persons per Room
Area 1			
Roxeth	15,403	27·3	0·67
Roxbourne	14,341	27·3	0·64
West Harrow	14,251	23·6	0·62
	43,995		
Area 2			
Kenton	13,344	24·9	0·61
Belmont	11,874	22·9	0·61
Stanmore South	13,363	25·9	0·67
	38,581		

TABLE II

MEAN WINTER SMOKE AND SULPHUR DIOXIDE (μg./cu.m.) FOR THE THREE SUCCESSIVE WINTERS 1962/63, 1963/64, and 1964/65

Winter*	Area 1 Site No. 3**		Area 2 Site No. 4**	
	Smoke	SO_2	Smoke	SO_2
1962/63	108	227	175	279
1963/64	101	276	141	272
1964/65	72	238	73	193

* Winter = December, January, February and March.
** Site No. 3 Roxeth Manor Secondary Modern School, South Harrow
Site No. 4 Chandos Secondary Modern School, Stanmore

It has been reliably reported that up to the late 1950s Area 1 had far worse air pollution than Area 2. This was one of the main reasons for choosing these two areas for the study. The apparent drop in air pollution levels in Area 1 since that time is almost certainly due to this area becoming in large part a smokeless zone in 1962/63.

STUDY POPULATION

The study was commenced on 1 July 1963. All families living within the six wards, who had a live newborn infant in the period from 1 July 1963 to 30 June 1965, were included in the study, whether delivery occurred within or outside these six electoral wards. The only exclusions were those families whose infants died within seven days of birth. A total of 2,365 families had a newborn baby during this period, and of these 2,205 (93 per cent.) were included in the study. The 160 families excluded from the study had either moved away from the area before they could be visited or refused to co-operate.

METHODS

Health visitors attached to the Harrow Health Department were trained to act as observers in the study. As a part of their routine duties health visitors usually visit all infants and mothers at home within 14 days after delivery. The health visitors were trained to administer at this initial visit three simple questionnaires. These were for the baby, the siblings of the baby, and the parents. The siblings' and parents' questionnaires consisted of questions to elicit the presence of respiratory symptoms, past respiratory illness, date and place of birth, and, in addition, details of the parents' occupation and siblings' schooling. The respiratory questions in the parents' questionnaire were adapted from the Questionnaires on Respiratory Symptoms, approved by the Medical Research Council (1960). Questions for the siblings were newly constructed for this study; they included questions about cough and phlegm production but no distinction was made between symptoms 'first thing in the morning' and 'during the day and the night'. For example, the question on cough was: 'Does he/she usually cough during the morning, day or night in the winter?' This was because of the expected low prevalence of symptoms in this age group and the necessity to limit questions to a minimum. The baby questionnaire contained questions about pregnancy, labour, state and normality of infant at birth, any illness since birth, and details of feeding. Information on the social and environmental conditions of the family were also recorded on this form.* Often, at this initial visit by the health visitor, the father or siblings may have been absent; in this case the questions were answered by the mother.

In order to enable measurements of ventilatory function to be performed, and to assess the reproducibility of the answers to the initial questionnaire, a team from St. Thomas' visited a sample of about 1 in 3 of the families. This sample was chosen by the baby's date of birth; if the baby was born on a date divisible by 3, *i.e.*, the 3rd, 6th, 9th, 12th . . . 30th day of the month, then the family would be visited by the St. Thomas' team. These visits took place in the late afternoon and evening when all family members might be present. At this visit the questionnaires were re-applied for all members of the family. The sitting height of the parents and sitting height and chest circumference of the siblings were measured in centimetres to the nearest 1 cm. below. The ventilatory function of both parents and siblings was recorded while they were seated using a Wright peak flow meter (W.P.F.M.). Five expirations were performed. For siblings under 5 years old the low range W.P.F.M. was used, as the mouthpiece is smaller than the normal range model. For all these lung function measurements disposable cardboard mouthpieces were used. In addition, the ventilatory function of the infant was measured during crying, using a recording pneumotachograph (Colley, 1965).

The population seen by the health visitors, and that seen by both health visitors and St. Thomas', are given in Table III.† The proportion of families co-operating with the health visitors (93·9 per cent.) is higher than that co-operating with St. Thomas' (91·9 per cent.). This is mainly due to families moving away before they could be visited by St. Thomas'.

*Copies of these questionnaires can be obtained on application to Professor W. W. Holland.

†Detailed tables, giving breakdown by area, social class, age, and smoking habit, are available on application to Professor W. W. Holland.

TABLE III
HARROW SURVEY POPULATION

	Visited by Health Visitor Only	Visited by Health Visitor and by St. Thomas'	Total
Total number of families with a newborn baby	1,580	785	2,365
Non co-operating families	96	64	160
Total co-operating families	1,484	721	2,205

TRAINING OF STAFF

Health Visitors.—Before the start of the study all the health visitors were trained by members of the Department of Social Medicine in the use of the questionnaires by practical demonstrations and by the use of the standard training tape-recording (Holland, 1963). The lung function tests were also demonstrated so that the health visitors could explain the tests in general terms to those families scheduled for a visit from St. Thomas' before the team visited.

Team from St. Thomas'.—For the first year of the study, 1 July 1963 to 1 August 1964, two observers made all the observations (W.W.H. and J.R.T.C.). A standard sequence for these measurements was always used. The questionnaires were completed first, then body and lung function measurements on the parents, and then on the siblings. Measurements of the infant were left until last. From 1 August 1964, two state registered nurses took over the visits, after training, and carried out the majority of visits thereafter. W.W.H. and J.R.T.C. made visits with them from time to time to check that they remained standard in the application of the questionnaires and measurements of body size and lung function.

ANALYSIS

The analysis is based, firstly, upon the data collected from the total co-operating families by the health visitor, and, secondly, upon the measurements of body size and ventilatory function made on the one-third sample seen by the St. Thomas' team. Twenty-six health visitors administered questionnaires in this study.

When the health visitors' responses were compared for the sibling, mother, and father questionnaires alone, certain health visitors obtained significantly higher or lower prevalence rates than the group as a whole. No single observer was found who consistently over- or under-recorded when questions from all family members were compared. It appears that if an observer significantly over- or under-recorded she did this for one family member only. However, the distribution of these observers between the two areas and between the social classes was such that they would not have introduced any consistent bias into the results. A similar comparison has been made for the four St. Thomas' observers and no significant differences were found between these observers.

A comparison was also made of the health visitors' findings with those obtained by the St. Thomas' team. In the health visitors' account of the fathers' symptoms, obtained usually from the mother, the health visitors tended to obtain a lower prevalence of 'morning phlegm' and of 'increased cough and phlegm' than did the St. Thomas' team, who obtained their answers direct from the father. These findings are similar to those reported from other studies in which the household interview of one family member has been employed to collect morbidity data on all family members (Feldman, 1960).

When a direct comparison was made between the health visitors' findings for an individual and the St. Thomas' findings for the same individual the level of agreement was reasonably high. This level of agreement compares favourably with that obtained in another study where the same observer made an assessment of respiratory symptom prevalence upon the same population after an interval of six months (Holland, Ashford, Colley, Morgan, and Pearson, 1966). We may, therefore, consider that the health visitors' findings are comparable with those obtained by the St. Thomas' observers.

Finally, the one-third sample of families seen by the St. Thomas' team was found to be a representative sample of the total survey population as regards social class, area distribution, and the age distribution of fathers, mothers, and siblings.

SMOKING HABIT, SOCIAL CLASS AND AREA

Age-adjusted prevalence ratios have been calculated for two respiratory symptoms for fathers and mothers.* These are (*a*) 'Do you usually cough first thing in the morning in the winter?', question 1 of the 1960 M.R.C. approved Questionnaire on Respiratory Symptoms, and (*b*) 'Do you usually bring up any phlegm from your chest first thing in the morning in the winter?', question 6 of the same questionnaire.

For the siblings the questions were (*a*) 'Does he/she usually cough during the morning, day or night in the winter?', and (*b*) 'Does he/she usually bring up any phlegm from his/her chest during the morning, day or night in the winter?'.*

The prevalence ratios are shown separately for

*Tables of symptom prevalence by smoking habit and age can be obtained from Professor W. W. Holland.

TABLE IV
SOCIAL CLASS, SMOKING, BY AREA, FOR FATHERS
(Age-Adjusted Prevalence Ratios) Mean = 100

Symptoms	Smoking Category	Area 1			Area 2		
		Social Class			Social Class		
		I & II	III	IV & V	I & II	III	IV & V
Winter morning cough	Present smokers	155	127	139	127	139	171
	Ex-smokers	43	28	145	14	45	68
	Non-smokers	41	51	65	24	29	69
Winter morning phlegm	Present smokers	136	111	123	100	148	149
	Ex-smokers	61	61	80	58	74	0
	Non-smokers	76	44	94	42	73	75

TABLE V
SOCIAL CLASS, SMOKING, BY AREA, FOR MOTHERS
(Age-Adjusted Prevalence Ratios) Mean = 100

Symptoms	Smoking Category	Area 1			Area 2		
		Social Class			Social Class		
		I & II	III	IV & V	I & II	III	IV & V
Winter morning cough	Present smokers	214	265	230	158	132	78
	Ex-smokers	56	53	100	68	44	0
	Non-smokers	59	70	27	26	26	0
Winter morning phlegm	Present smokers	141	161	245	135	131	135
	Ex-smokers	70	32	171	88	53	169
	Non-smokers	71	74	77	56	44	45

TABLE VI
RESPIRATORY SYMPTOMS, SOCIAL CLASS, BY AREA, FOR MALE AND FEMALE SIBLINGS
(Age-Adjusted Prevalence Ratios) Mean = 100

	Symptoms	Area 1			Area 2		
		Social Class			Social Class		
		I & II	III	IV & V	I & II	III	IV & V
Male siblings	Winter cough	132	105	151	123	52	89
	Winter phlegm	162	110	127	118	36	147
Female siblings	Winter cough	105	119	104	84	74	64
	Winter phlegm	157	120	0	78	62	85

fathers, mothers, and male and female siblings in Tables IV, V, and VI. The social class classification is based upon the father's occupation (General Register Office, 1966).

Smoking Habit.—The proportion of smokers among the siblings is too small for separate analysis. In both fathers and mothers, present smokers have a higher symptom prevalence than ex- and non-smokers. This difference is statistically highly significant ($P < 0{\cdot}005$).

Social Class.—There is no consistent social class gradient in prevalence for either of the symptoms in the mothers or in the male and female siblings. In the fathers, in Area 2 there is a social class gradient for both symptoms, within each smoking category. Social classes I and II have a lower prevalence, and prevalence rises from social class III to IV and V. In Area 1, among non-smokers for the 'winter morning cough' question, there is also a gradient although there is no consistent gradient for present and ex-smokers in this area. However, none of these gradients is statistically significant. If findings from both areas are combined a social class trend is present in smokers and in non-smokers, but this trend is not statistically significant.

Area.—The prevalence of symptoms in the fathers living in the two areas, comparing the same social classes in the same smoking category, reveals no wholly consistent or significant difference between the areas.

In contrast, both in the mothers and in the siblings a difference in symptom prevalence exists between the areas. It is not wholly consistent in the mothers as ex-smokers do not follow the trend seen in present and non-smokers, where symptom prevalence is higher in Area 1 than in Area 2. This difference is only statistically significant for the 'winter morning cough' question ($P < 0{\cdot}005$).

Influence of Crowding upon Symptom Prevalence

The number of persons per room was obtained by dividing the number of persons in the dwelling by the total number of rooms, excluding bathroom and lavatory, and kitchen when this was not used as a dining room. In Table VII are the age-adjusted prevalence ratios for the symptom 'winter morning cough' in present smokers, by social class and persons per room for fathers and for mothers. In ex- and non-smokers numbers are too small to calculate reliable prevalence ratios.

Table VII

WINTER MORNING COUGH, SOCIAL CLASS, IN PRESENT SMOKERS BY PERSONS PER ROOM, FOR FATHERS AND MOTHERS
(Age-Adjusted Prevalence Ratios) Mean = 100

Persons/room	Fathers			Mothers		
	Social Class			Social Class		
	I & II	III	IV & V	I & II	III	IV & V
< 1·0	130	105	169	136	145	238
1·0–1·4	153	147	155	224	254	175
1·5–1·9	139	170	147	278	227	155
⩾2·0	263	177	100	741	389	108
All	141	125	151	187	210	180

Mothers and fathers in social classes I and II, living at two or more persons per room, have a higher prevalence of winter morning cough than mothers and fathers living in less crowded conditions. By contrast, in social classes IV and V there is an opposite trend; symptom prevalence increases with less crowded conditions. However, these ratios, particularly those for crowding at two or more persons per room, are based on small numbers and these differences are not statistically significant.

Influence of Season upon Responses to Respiratory Questions

Symptom prevalence might vary according to the time of the year the questions were asked of respondents. Thus, respondents might show a higher prevalence when questions were asked in the winter than in the summer, as symptom prevalence tends to be higher in winter. During the summer, memory of events in the preceding winter may be poorer than if questions are asked during the winter.

The prevalence of each respiratory symptom for each of the 12 months of the year (combining the data for the two pairs of months, *e.g.* the two Januaries, two Februaries, etc.), has been calculated without making any adjustment for age. This has been done for questions from fathers', mothers', male siblings', and female siblings' questionnaires, and the resulting prevalence rates were tested for the presence of a significant monthly trend. While there is the suggestion of a monthly trend prevalence tending to be higher in the winter, this was not significant except for chest illness in male siblings.

Table VIII

AGE-ADJUSTED PREVALENCE RATIO FOR RESPIRATORY SYMPTOMS FOR FATHERS AND MOTHERS BY SEASON OF YEAR QUESTIONS WERE ASKED

Symptoms	Jan. Feb. Mar.	Apr. May Jun.	Jul. Aug. Sep.	Oct. Nov. Dec.
Fathers				
Morning cough in winter	98	87	102	115
Cough for 3/12	108	88	95	113
Morning phlegm in winter	115	105	87	92
Phlegm for 3/12	121	104	77	99
Mothers				
Morning cough in winter	104	99	89	111
Cough for 3/12	108	118	76	95
Morning phlegm in winter	108	91	112	90
Phlegm for 3/12	83	109	126	80
Male siblings				
Winter cough	133	83	98	95
Cough for 3/12	105	75	107	117
Winter phlegm	94	105	105	95
Phlegm for 3/12	72	102	137	83
Female siblings				
Winter cough	119	92	82	114
Cough for 3/12	121	79	98	113
Winter phlegm	140	62	115	94
Phlegm for 3/12	163	88	59	110

As an extension of this analysis the prevalence rates have been adjusted for age, and the monthly rates have been combined to provide an age-adjusted prevalence ratio by season for selected symptoms (Table VIII). There is no consistent seasonal trend in symptom prevalence.

Ventilatory Function (Standardized P.E.F.R.), Social Class, Smoking, and Area

The mean sitting height and age-adjusted peak expiratory flow rate (P.E.F.R.) (l./min.)* of the sample seen by the St. Thomas' team, in the same sub-groups as in the preceding sections, are given in Tables IX and X.

*Copies of the regression equations are available from Professor W. W. Holland.

Table IX

STANDARDIZED P.E.F.R. (l./min.), SOCIAL CLASS, SMOKING, BY AREA, FOR FATHERS AND MOTHERS

Symptoms	Area 1			Area 2		
	Social Class			Social Class		
	I & II	III	IV & V	I & II	III	IV & V
Fathers						
Present smokers	545	540	516	529	538	485
Ex-smokers	554	541	518	526	557	586
Non-smokers	557	545	526	560	524	498
Mothers						
Present smokers	365	383	397	381	400	389
Ex-smokers	395	396	372	411	409	371
Non-smokers	389	397	402	402	397	353

TABLE X
STANDARDIZED P.E.F.R. (l./min.) BY SOCIAL CLASS AND AREA FOR MALE AND FEMALE SIBLINGS

Sex	Area 1			Area 2		
	Social Class			Social Class		
	I & II	III	IV & V	I & II	III	IV & V
Male	182	192	197	198	189	190
Female	187	190	213	188	205	184

Non-smoking fathers and mothers tend to have a higher P.E.F.R. than smokers. The differences are small and not statistically significant. There is no wholly consistent social class gradient in P.E.F.R. for the fathers and no area difference for P.E.F.R. for either the mothers or siblings.

DISCUSSION

The reliability of answers to interviewer-administered questionnaires has been studied in groups where the questions asked concern the respondent's health (Fairbairn, Wood, and Fletcher, 1959; Holland *et al.*, 1966). In our study it was usually the mother who answered the questions about her own health and also those of her husband and children. Kosa, Alpett, and Haggerty (1967) conclude from a study of a group of mothers with relatively low educational achievement that the account these mothers gave of their families' health may be unreliable due in part to selective censorship. They find that medical events that these mothers did not consider to be relevant are not reported. This might suggest that in this present study selective censorship, particularly by mothers in social classes IV and V, could result in systematic under-reporting of respiratory symptoms. We feel this is unlikely to have occurred. The questions used to elicit the presence of respiratory symptoms in the parents were taken from the Medical Research Council's approved questionnaire. We know of no evidence that suggests that when questions from this questionnaire have been asked of persons in social classes IV and V selective under-reporting has occurred.

The repeatability of answers to the questions in our study is at least as good as that in other studies (Holland *et al.*, 1966). There are, however, small systematic differences in answers given by the mother about her husband's symptoms and those given by the husband. These differences should not affect any of the comparisons between subgroups of fathers.

Of the various factors studied for their association with respiratory symptoms, smoking is clearly seen to have a far greater influence than any other. The effect of smoking upon symptom prevalence is present in both fathers and mothers. It is of interest that even in the age group 15–24 years there is a marked contrast in symptom prevalence between smokers and non- and ex-smokers for each of the symptoms studied. This confirms the suggestion that exposure to tobacco-smoke over a short time span can result in a significant increase in symptom prevalence in comparison with non-smokers (Holland and Elliott, 1968). Symptom prevalence in smokers rises with age, in contrast with non-smokers where the levels remain steady. This significant age trend in smokers may be a reflection of the time exposed to the irritant effects of cigarette smoke. The highly susceptible develop symptoms early and the more resistant only after a more prolonged exposure. The absence of an age trend for symptom prevalence in non-smokers might suggest that non-smokers, if they are to develop 'winter morning cough', do so in later childhood and early adult life, and that the proportion of adults who later acquire this symptom must be small. We should, however, be careful in drawing many conclusions from these data. It could be that the 15–24 age group, by the time they reach middle life, will show a higher symptom prevalence than at present, although as environmental conditions are certainly not likely to become worse, this may seem an unlikely event.

Studies on older age groups of men and women have demonstrated a social class gradient for combinations of symptoms independent of smoking habit (College of General Practitioners, 1961). It could be that these fathers, due to their relative youth, have not been exposed for a significant length of time to occupational and other environmental factors for a social class gradient to be more than a minor, non-significant trend.

On the other hand, these fathers are a different generation from those older men investigated in earlier studies. It could well be that these fathers may never develop the marked social class gradient in respiratory symptoms seen in older men. Those factors responsible for the social class gradient in older men may have diminished in importance to the point where today they produce no detectable effect.

The absence of a social class gradient in mothers and siblings suggests that, although there may be factors in the home environment that have an adverse effect upon respiratory disease, they are not directly related to social class; if they are related to social class then they are swamped by other unrelated factors that have a far greater effect. It is only possible to guess at these, but factors such as degree of social contacts, opportunity for infection, uses of available medical care, and the way in which available income is used could all influence the

prevalence levels in ways unrelated directly to social class. The mothers, like the fathers, may be too young for those factors associated with social class to have an influence upon respiratory symptoms.

Studies of the more severe respiratory illnesses in childhood (Grundy and Lewis-Faning, 1957; Douglas and Blomfield, 1958) have demonstrated a social class gradient. Lunn, Knowelden, and Handyside (1967) found a social class gradient for a history of persistent or frequent cough in 5-year-old children in Sheffield. It does seem possible that the contrast between the social classes in domestic environment in Harrow is smaller than that for the populations studied previously. This could account for the absence of a social class gradient in mothers and siblings. Alternatively, the number of persons studied may be too small to enable a social class gradient, if present, to be detected.

The area differences in symptom prevalence in both mothers and siblings, a higher prevalence in Area 1 than 2, raises the possibility that air pollution might be a factor in determining symptom prevalence. Although current air pollution levels do not differ between the areas, in the past Area 1 almost certainly had higher levels. It is possible that any adverse effect upon the respiratory system due to air pollution does not immediately regress when pollution levels drop, and the present area differences could be residual effects of higher air pollution in the past.

Children in the 5–9 years age group showed the highest prevalence of respiratory symptoms. This is in contrast with the study of Dingle, Badger, Feller, Hodges, Jordan, and Rammelkamp (1953) in a middle and upper class group of families in Cleveland, and of Brimblecombe, Cruickshank, Masters, Reid, Stewart, and Sanderson (1958) in a working-class group of families in London, who found the highest incidence rate for respiratory disease was in the pre-school child. Our findings might be explained by the exposure of these children to high levels of air pollution in early life resulting in residual effects upon the respiratory tract. However, a possibly more likely explanation is the greater opportunity for contact with respiratory infections occasioned by attendance at school.

There is a suggestion of a seasonal trend in symptom prevalence. The symptom prevalence of respondents who were asked the questions in the winter tended to be higher than those who were asked the same questions in the summer. However, the trend was not statistically significant. This finding casts doubt upon the necessity of conducting prevalence studies at particular times of the year, such as May or October, in populations that are relatively young. In contrast, studies on older age groups (Crooke, Morgan, Pasqual, and Ashford, 1964) demonstrated a seasonal trend in response to respiratory questions.

The lack of a significant difference in ventilatory function between the non and present smokers requires some explanation in view of the large differences in symptom prevalence between these groups. It seems logical to assume that chronic respiratory disease must reach a certain degree of severity before, even in group comparisons, differences between the diseased and the non-diseased become large enough to reach significance. The relative youth of this population is probably the explanation for the lack of a significant difference in ventilatory function between non and present smokers. This finding emphasizes the apparent sensitivity of the symptom questions as indicators of early pulmonary disease.

Summary

This paper describes the methodology employed in a study of respiratory disease in a large group of families living in two areas in a suburb in north-west London, the characteristics of the areas, and certain features of the local environment. The study population consists of families who had a newborn baby between 1 July 1963 and 30 June 1965, a total of 2,206 families. Information on respiratory symptoms and other relevant data on all family members were collected by health visitors, using questionnaires, shortly after the birth of the baby. One-third of these families were revisited by a team from St. Thomas's Hospital Medical School, when the P.E.F.R. and sitting height were measured.

(1) In both fathers and mothers present smokers have a higher prevalence of respiratory symptoms than non- and ex-smokers.

(2) In non-smokers there is a social class gradient for winter morning cough in fathers. Prevalence is low in social classes I and II and rises from III up to IV and V.

(3) No such social class gradient is present in mothers and siblings.

(4) In fathers there is no difference in symptom prevalence, within social class and smoking category, between the two study areas.

(5) In mothers symptom prevalence is higher in Area 1 than in Area 2 for present and non-smokers, but there is no difference in ex-smokers.

(6) Siblings, like mothers, show a higher symptom prevalence in Area 1.

(7) In fathers and mothers non-smokers had a higher P.E.F.R. than present smokers but these

differences are not significant. There were no social class or area differences in the P.E.F.R. measurement in fathers, mothers, or siblings.

This study was undertaken in conjunction with the London Borough of Harrow Health, Welfare and Children's Department. We would particularly like to thank Miss I. Watson and Miss M. S. Hirschhorn, Superintendent Health Visitors, and their staff, and Mr G. Phipps, Senior Administrative Assistant in the Personnel Health Section and his staff, and all other individuals who took part for their help and co-operation.

Our thanks go to Miss C. Astbury, Miss S. Brenner, Miss P. Cox, Miss J. Dale, Miss H. Polak, and Miss A. Witts for maintaining the records and doing the majority of the field work.

Punching of the records has been done by Mr S. G. Nicholas and the coding and analysis by Mrs J. Blake, Mr R. Corkhill, and Miss Z. Sameja to whom we are grateful. The analysis was undertaken on the IBM 7090 computer at Imperial College. Funds for the study were made available by the Board of Governors of St. Thomas's Hospital through their grant for Locally Organized Clinical Research.

REFERENCES

BRIMBLECOMBE, F. S. W., CRUICKSHANK, R., MASTERS, P. L., REID, D. D., STEWART, G. T., and SANDERSON, D. (1958). Family studies of respiratory infections. *Brit. med. J.*, **1**, 119.

College of General Practitioners. (1961). Chronic bronchitis in Great Britain; a national survey. *Ibid*, **2**, 973.

COLLEY, J. R. T. (1965). A method for measuring lung function in babies suitable for the epidemiologists. *J. Physiol. (Lond.)*, **177**, 40P.

——, and HOLLAND, W. W. (1967). Social and environmental factors in respiratory disease. *Arch. environm. Hlth*, **14**, 157.

CROOKE MORGAN, D., PASQUAL, R. S. H., and ASHFORD, J. R. (1964). Seasonal variations in the measurement of ventilatory capacity and in the answers of working coal miners to a respiratory symptoms questionary. *Brit. J. prev. soc. Med.*, **18**, 88.

DOUGLAS, J. W. B., and BLOMFIELD, J. M. (1958). *Children under Five*. George Allen and Unwin, London.

DINGLE, J. H., BADGER, G. F., FELLER, A. E., HODGES, R. J., JORDAN, W. S. jr., and RAMMELKAMP, C. H. jr. (1953). A study of illness in a group of Cleveland families. *Amer. J. Hyg.*, **58**, 16.

FAIRBAIRN, A. S., WOOD, C. H., and FLETCHER, C. M. (1959). Variability in answers to a questionnaire on respiratory symptoms. *Brit. J. prev. soc. Med.*, **13**, 175.

FELDMAN, J. J. (1960). The household interview survey as a technique for the collection of morbidity data. *J. chron. Dis.*, **11**, 535.

General Register Office. (1966). *Classification of Occupations* 1966. H.M.S.O., London.

GRUNDY, F., and LEWIS-FANING, E. (1957). *Morbidity and Mortality in the First Year of Life—A Field Enquiry in* 15 *areas of England and Wales*. The Eugenics Society, London.

HOLLAND, W. W. (1963). A respiratory disease study of industrial groups. Design and conduct. *Arch. environm. Hlth*, **6**, 9.

——, ASHFORD, J. R., COLLEY, J. R. T., MORGAN, D. C., and PEARSON, N. J. (1966). A comparison of two respiratory symptoms questionnaires. *Brit. J. prev. soc. Med.*, **20**, 76.

——, and ELLIOTT, A. (1968). Cigarette smoking, respiratory symptoms, and anti-smoking propaganda. *Lancet*, **1**, 41.

KOSA, J., ALPERT, J. J., and HAGGERTY, R. J. (1967). On the reliability of family health information. *Soc. Sci. Med.*, **1**, 165.

LUNN, J. E., KNOWELDEN, J., and HANDYSIDE, A. J. (1967). Patterns of respiratory illness in Sheffield-infant schoolchildren. *Brit. J. prev. soc. Med.*, **21**, 7.

M.R.C. Committee on the Aetiology of Chronic Bronchitis. (1960). Standardized questionnaires on respiratory symptoms. *Brit. med. J.*, **2**, 1665.