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Chronic respiratory disease in the elderly

A population study

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A study has been made of chronic respiratory disease among 83 men and 217 women aged 65 and over, randomly chosen from those living in their own homes. Twenty-six per cent of the men and 13% of the women had chronic bronchitis. The prevalence of chronic bronchitis was related to current cigarette smoking in both sexes, and to socio-economic status in men. Chronic bronchitis was a contributory cause of disabling dyspnoea and recurrent chest illness in half of the subjects with these symptoms.

Significant radiological evidence of tuberculosis was found in 9% of men and in 4% of women, asthma in 2% of women, industrial lung disease in 4% of men, and bronchogenic carcinoma in three subjects.

Chronic respiratory disease is an important cause of morbidity and mortality in old age. Thus chronic bronchitis and bronchogenic carcinoma each account for approximately 7% of male and 2% of female deaths over the age of 65 in Scotland (Registrar General for Scotland, 1971). Death rates from bronchitis in men over the age of 65 have risen steadily over the past 15 years (Crofton, 1970). The notification rate for pulmonary tuberculosis detected at mass miniature radiography increases with age in men (Hawthorne, 1970).

There have been many studies of the prevalence of chronic respiratory disease, particularly of chronic bronchitis, in middle age (College of General Practitioners, 1961; Reid, Anderson, Ferris, and Fletcher, 1964). There are reports from the United States (Ferris and Anderson, 1962), Canada (Anderson, Ferris, and Zickmantel, 1965), and Finland (Huhti, 1966) on the frequency of chronic respiratory disease in the elderly, but little attention has been paid to this in the United Kingdom. The present study, which is part of a detailed clinical, laboratory, and social survey of a random sample of elderly people living at home, represents an attempt to investigate the prevalence and significance of chronic respiratory disease in old age.

METHODS

A random sample was drawn from the names of people aged 65 and over on the lists of six general practitioners, three from each of two socially contrasted areas of northern Glasgow. The sample was stratified by age by the rejection of one name in two of those aged 65 to 74, so that the proportion of those aged 75 and over was increased from approximately one in three to approximately one in two. About 30% of those approached refused to participate. The survey continued until 300 people had taken part.

A social and occupational history was taken from each subject. Men and single women were classified according to the occupation at which they had been employed the longest, married women and widows by their husband's occupation. Socio-economic group (SEG) was determined from the Classification of Occupations (General Register Office, 1966). The SEGs were combined into five categories (A to E) as shown in Table I, which compares the distribution of these categories in the sample with the best estimate for the population from which the sample was drawn. This estimate is derived from data at the 1966 census for retired men in the parliamentary constituencies of Hillhead, Maryhill, Scotstoun, and Woodside (General Register Office, 1969). The sample contains

TABLE I

SOCIO-ECONOMIC GROUPS IN SAMPLE AND POPULATION

SEG Category	SEGs in Category	Registrar General's Social Class[1]	Sample			% of Total	% of Population[2]
			M	F	M+F		
A	1, 2, 3, 4, 13	I and II	15	32	47	16	10
B	5, 6	IIINm	17	69	86	29	20
C	8, 9, 12, 14	IIIM	34	70	104	35	36
D	7, 10, 11, 15	IV and V	15	38	53	18	29
E	16, 17	—	2	8	10	3	5

[1]Approximate correspondence; category E contains armed Forces and unclassifiable occupations.
[2]See Methods.

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an excess of subjects in SEG categories A and B, and a deficit in category D, compared with the population.

A full medical history, including a standard questionnaire on respiratory symptoms (Medical Research Council, 1966), and supplemented where appropriate by reference to general practitioner and hospital records, was obtained from each subject, and a detailed clinical examination was carried out. Except in those whose general condition necessitated examination at home rather than at a clinic, a 6-foot postereo-anterior and left lateral radiograph was taken; the one-second forced expiratory volume (FEV_1) and forced vital capacity (FVC) were measured with the subject seated, using a Garthur Vitalograph spirometer; the peak expiratory flow rate (PEFR) was determined (Wright and McKerrow, 1959) and the standing height measured. In the tests of ventilatory function, the mean of three tests after two practice blows was recorded.

DEFINITIONS The chest radiographs were classified on the basis of a radiologist's report as being normal, or as showing either minor or significant abnormality. Minor abnormality was considered to be present when such lesions as pleural thickening, a primary tuberculosis complex, or small foci of healed post-primary tuberculosis were shown; these lesions were not thought to give rise to abnormality of respiratory function nor to require further follow-up. All other lesions were considered significant and included:

(*a*) pulmonary tuberculosis: there were more substantial lesions present, often with fibrotic contracture of one or both upper lobes, and at least further follow-up was considered desirable;

(*b*) bronchogenic carcinoma;

(*c*) industrial lung disease: pleural plaques typical of asbestosis were present (see Selikoff, 1965), or there was evidence of pneumoconiosis, and the occupational history was consistent;

(*d*) miscellaneous radiological abnormality: there were appearances indicating fibrotic lesions not typical of any specific respiratory disorder.

Chronic bronchitis was diagnosed in those subjects who admitted to cough and/or phlegm for three months in each of the past three years (affirmative answers to Q 1 and/or Q 5; and/or to Q 3 and/or Q 7; and to Q 10 in the questionnaire), provided the chest radiograph was normal or showed only minor abnormality as defined above. Asthma was diagnosed when there was a clear history of recurrent episodes of wheezing and dyspnoea, without cough or phlegm, usually dating back into early adult life. The subject was considered to have no significant respiratory disease if neither chronic bronchitis nor asthma was diagnosed and the chest radiograph was normal or showed only minor abnormalities.

RESULTS

Eighty-three men and 217 women participated in the survey, and a chest radiograph was obtained in 277 (92% of the total) (Table II); 58% of the

TABLE II

RESPIRATORY DIAGNOSES

Age (yr)	Male			Female		
	65–74	75+	Total	65–74	75+	Total
Total No.	49	34	83	110	107	217
No chest radiograph	0	1	1	9	13	22
Chest radiograph	49	33	82	101	94	195
No significant respiratory disease	29 (59%)	19 (56%)	48 (58%)	81 (80%)	75 (81%)	156 (80%)
(Minor radiological abnormality)	(12)	(7)	(19)	(10)	(18)	(28)
Chronic bronchitis	13 (26%)	8 (24%)	21 (26%)	14 (14%)	12 (13%)	26 (13%)
Asthma	0	0	0	3	1	4 (2%)
Pulmonary tuberculosis	3	4	7 (9%)	3	4	7 (4%)
Bronchogenic carcinoma	1	1	2 (2%)	0	0	0
Industrial lung disease	3	0	3 (4%)	0	0	0
Miscellaneous abnormality	0	1	1 (1%)	0	2	2 (1%)

TABLE III

SOCIO-ECONOMIC GROUP AND CHRONIC RESPIRATORY DISEASE

SEG Category	No Significant Respiratory Disease		Chronic Bronchitis		Other Respiratory Disease		Total		Chronic Bronchitis as % of Total	
	M	F	M	F	M	F	M	F	M	F
A	14	26	0	4	1	1	15	31	0	13
B	10	49	3	8	4	7	17	64	18	13
C	18	49	11	8	5	4	34	61	32	13
D	5	26	7	4	2	1	14	31	50	13
E	1	6	0	2	1	0	2	8	—	—

Subjects without chest radiograph excluded.

TABLE IV

CURRENT SMOKING HABITS AND CHRONIC RESPIRATORY DISEASE

Amount Smoked	No Significant Respiratory Disease		Chronic Bronchitis		Other Respiratory Disease		Total		Chronic Bronchitis as % of Total		
	M	F	M	F	M	F	M	F	M	F	Total
Never smoked	3	126	2	16	0	9	5	151	40	11	12
Cigarettes per day											
1–4	1	1	0	2	0	1	1	4	17	13	15
5–14	11	10	3	0	3	1	17	11			
15–24	4	4	7	6	5	1	16	11	47	50	48
25+	0	1	2	1	1	1	3	3			
Pipe or cigar	13	–	4	–	1	–	18	–	22	–	–
Mixed[1]	5	–	0	–	0	–	5	–	–	–	–
Ex-cigarette	11	14	2	1	3	0	16	15	13	7	10
Ex-pipe	0	–	1	–	0	–	1	–	–	–	–

Subjects without chest radiograph excluded.
[1]Current smokers of pipes and cigarettes.

men and 80% of the women were considered to have no significant respiratory disease; 19 of 48 men (38%) and 28 of 156 women (18%) without significant respiratory disease had minor radiological abnormalities as defined.

Of those in whom a chest radiograph was obtained, 21 men and 26 women had chronic bronchitis (Table II). The prevalence of 26% in men and 13% in women did not vary with age. Four women had asthma. Fourteen subjects (7 men and 7 women) had significant radiological abnormality due to tuberculosis; four were known to have had radiological changes previously, and two of these had received treatment for tuberculosis. Two men had radiological evidence of bronchogenic carcinoma, which was subsequently confirmed by necropsy in both. Two retired shipyard workers had pleural calcification attributed to asbestosis, and one retired moulder had radiological evidence of siderosis. Three subjects had miscellaneous radiological abnormalities as defined.

The prevalence of chronic bronchitis increased with declining socio-economic status in men, being zero in those in category A and 50% in those in category D (Table III). No such trend is seen in women. In both sexes, current smoking habits are related to the prevalence of chronic bronchitis (Table IV). The prevalence is 12% among those who have never smoked, and approaches 50% in those who smoke more than 15 cigarettes per day.

Subjects with chronic bronchitis more often

TABLE V

RESPIRATORY SYMPTOMS

	No Significant Respiratory Disease		Chronic Bronchitis		Other Respiratory Disease		Total	
	M	F	M	F	M	F	M	F
Total No.	48	156	21	26	13	13	82	195
No. with:								
Dyspnoea[1] gr. 0	30 (63%)	69 (44%)	7 (33%)	8 (32%)	4 (31%)	6 (46%)	41 50%)	83 (43%)
1	15 (31%)	65 (42%)	6 (29%)	6 (23%)	5 (38%)	2 (15%)	26 32%)	73 (38%)
2	2 (4%)	8 (5%)	3 (14%)	2 (8%)	1 (8%)	2 (16%)	6 (7%)	12 (6%)
3+	1 (2%)	14 (9%)	5 (24%)	10 (38%)	3 (23%)	3 (23%)	9 (11%)	27 (13%)
Chest illness[2]								
Once or more ..	5 (10%)	23 (15%)	9 (43%)	16 (62%)	6 (46%)	3 (23%)	20 (25%)	42 (21%)
Twice or more ..	4 (9%)	10 (6%)	6 (29%)	11 (42%)	6 (46%)	3 (23%)	16 (20%)	24 (12%)
Wheezing[3]	8 (17%)	21 (14%)	8 (38%)	20 (77%)	5 (38%)	8 (62%)	21 (26%)	49 (25%)
Effect of weather ..	4 (9%)	28 (18%)	8 (38%)	13 (50%)	6 (46%)	5 (40%)	18 (22%)	46 (24%)

[1]Dyspnoea grades from questionnaire (MRC, 1966).
[2]Chest illness in past three years.
[3]Wheezing on most days or nights.
Subjects without chest radiograph excluded.

TABLE VI

RESPIRATORY FUNCTION TESTS

	Age	Male				Female			
		No.	No Significant Respiratory Disease (mean ± SD)	No.	Chronic Bronchitis (mean ± SD)	No.	No Significant Respiratory Disease (mean ± SD)	No.	Chronic Bronchitis (mean ± SD)
Height (cm)	65–74	29	167·1 ± 5·4	13	164·1 ± 5·4	75	155·9 ± 6·0	14	149·6 ± 5·3
	75+	19	165·6 ± 7·5	13	164·3 ± 6·0	72	152·9 ± 6·6	10	152·6 ± 3·6
FEV (l.)	65–74	30	2·04 ± 0·59	11	1·35 ± 0·31	78	1·43 ± 0·37	12	0·91 ± 0·37
	75+	19	1·76 ± 0·55	8	1·47 ± 0·39	64	1·11 ± 0·31	11	1·12 ± 0·33
FVC (l.)	65–74	30	2·72 ± 0·60	11	2·15 ± 0·34	78	1·79 ± 0·43	12	1·22 ± 0·40
	75+	19	2·54 ± 0·61	8	2·12 ± 0·53	64	1·43 ± 0·34	11	1·44 ± 0·36
FEV % FVC	65–74	30	74·3 ± 9·4	11	63·4 ± 9·5	78	79·5 ± 8·4	12	73·9 ± 10·3
	75+	19	70·8 ± 13·1	8	69·1 ± 10·8	64	77·8 ± 9·6	11	77·1 ± 11·9
PEFR (l./min)	65–74	29	377 ± 125	12	221 ± 75	79	256 ± 75	13	169 ± 79
	75+	18	350 ± 112	8	236 ± 62	67	216 ± 75	11	215 ± 84

admitted to shortness of breath when walking at their own pace on level ground (i.e., dyspnoea of grade 3 or more) than subjects without respiratory disease (Table V), and more had had a recent chest illness, wheezing, and an effect of weather on the chest. Of the 36 subjects with dyspnoea of grade 3 or more, 15 (42%) had chronic bronchitis and 6 more (17%) had other respiratory disease. Of the 40 subjects who had had two or more chest illnesses in the past three years, 17 (43%) had chronic bronchitis and 9 more (21%) had other respiratory disease.

Table VI sets out the results of the ventilatory function tests. There are differences in mean height between the various groups. Thus subjects of either sex without significant respiratory disease over the age of 75 are shorter on average, by 1·5 to 3 cm, than those under that age. Subjects under 75 with chronic bronchitis are 3 to 6 cm shorter than those of the same age without respiratory disease. The mean FEV_1 of those without respiratory disease is less, by 0·3 1., in those over than in those under 75. There is a similar fall in FVC, FEV % FVC, and PEFR. Under the age of 75, subjects of either sex with chronic bronchitis have lower mean values for these tests than those without respiratory disease, but this difference is not apparent in subjects over the age of 75. Indeed, the mean values for women over the age of 75 with chronic bronchitis are almost identical with those of women of the same age without significant respiratory disease.

Of the 23 subjects (22 women and 1 man) in whom a chest radiograph was not obtained, two women had symptoms of chronic bronchitis. One had a bronchogenic carcinoma: an opacity had been shown in the right upper lobe during a hospital admission six months previously, and at the time of the survey she had a superior pulmonary sulcus syndrome, with signs of involvement of the brachial plexus, Horner's syndrome, and obstruction to the right innominate vein.

DISCUSSION

It is unlikely that significant bias has been introduced into the present study by the relatively high proportion of subjects who refused to take part, since in two very similar investigations with similar refusal rates those who agreed and those who refused to participate were shown not to differ to any important degree as far as their physical health was concerned (Milne, Maule, and Williamson, 1971; Akhtar, 1972). Nor will the failure to obtain chest radiographs on 11% of the women greatly affect calculated prevalence rates. However, the difference in distribution of socio-economic groups between the sample and the population from which it was drawn, which results from the derivation of the sample from two socially contrasted areas, will reduce the prevalence rate of any condition, such as chronic bronchitis, which shows a gradient of prevalence according to socio-economic status (Tables I and III). With this exception, the findings can be applied with reasonable confidence to the elderly population in Glasgow, and probably elsewhere in urban Scotland.

The clinical and radiological diagnostic criteria are thought to be realistic. There was no difficulty in assigning chest radiographs to the categories of minor and significant abnormality, nor in distinguishing those subjects considered to have asthma. The prevalence rates for asthma (2% of women), 'significant' pulmonary tuberculosis (9% of men and 4% of women), and industrial lung disease (4% of men) are thus likely to be reasonable approximations to the truth for the population studied. The prevalence rates for pulmonary tuberculosis and asthma found by Huhti (1966) in old people in rural Finland are of the same order. To find three subjects with bronchogenic carcinoma is not surprising, since mortality data show this to be common in this age group (Registrar General for Scotland, 1971).

Chronic bronchitis is quantitatively the most important chronic respiratory disorder encountered in the present study. In middle age a gradient by socio-economic status is demonstrable for both sexes for both the prevalence of chronic bronchitis (College of General Practitioners, 1961) and its mortality (see Lowe, 1968), though it is less steep in women than in men. In the present study such a gradient was shown only in men (Table III). It is not definitely due to differences in smoking habits; 26% of men in SEG categories A and B smoke more than five cigarettes per day, as do 41% of men in categories C and D. The corresponding figures for women are 15% and 8%. Neither of the differences reaches statistical significance. Correction of the prevalence rate for the difference in distribution of SEG categories between the sample and the population results in a small increase in the calculated prevalence of chronic bronchitis in the elderly male population, from 26% to 30%.

The importance of cigarette smoking in the genesis of chronic bronchitis in old age is shown in Table IV. The prevalence of 12% among those who have never smoked may reflect the element

of urban atmospheric pollution which contributes to the morbidity and mortality from bronchitis (Holland and Reid, 1965), though Huhti (1966) found a very similar prevalence of chronic bronchitis in non-smoking elderly women in rural Finland. Preliminary enquiries also suggest that some at least of the elderly women in the present study who have chronic bronchitis but have never smoked had respiratory disease in childhood. The same is true of middle-aged male bronchitics who have never smoked (Fletcher, 1965).

The subjects with chronic bronchitis differ from those without respiratory disease in a much greater frequency of disabling dyspnoea, recurrent chest illness, wheezing, and effect of weather on the chest (Table V). The 47 chronic bronchitics included as many subjects with dyspnoea of grade 3 or more, and more with two or more chest illnesses in the past three years, than the 204 without significant respiratory disease. This is some measure of the morbidity of this disorder in old age.

The values for ventilatory function tests shown in Table VI for elderly subjects without respiratory disease are in keeping with those found by others (Flint and Khan, 1962; Milne and Williamson, 1972), but difficulties in interpretation result from the differences in height between the various groups. The fall with age in mean FEV_1 and FVC cannot be due entirely to the shorter stature of the older subjects since the regression coefficients on height of FEV_1 (0·028 l/cm in men and 0·024 l/cm in women under 75) and FVC (0·022 and 0·032 l/cm respectively) are such that the differences in height could account for only one-sixth and one-third of the observed decline with age. Similarly, the differences in mean height between the subjects under 75 without respiratory disease and those with chronic bronchitis could account for only 12% of the difference in mean FEV_1 and 13% of that in FVC in men; the corresponding figures for women are 29% and 36%. The finding that the mean values for bronchitics over 75 are little lower than, and in women indeed virtually identical with, those of bronchitics under that age is no doubt due to the earlier death of bronchitics with greater impairment of ventilatory function. It has been shown that the decline in FEV_1 with age is greater the lower its initial value (Fletcher, 1967).

In summary, this study shows the substantial prevalence of chronic respiratory disease in the elderly: 40% in men and 20% in women. Chronic bronchitis, in particular, makes a major contribution to disabling dyspnoea and to recurrent respiratory infections, and cigarette smoking is significantly associated with its prevalence.

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