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Prevalence of chronic bronchitis in Rhodesian Africans

J. B. COOKSON[1] AND G. MATAKA

From The Department of Medicine, University of Rhodesia, PO Box ST494, Southerton, Salisbury, Rhodesia

Cookson, J. B., and Mataka, G. (1978). *Thorax*, **33**, 328–334. **Prevalence of chronic bronchitis in Rhodesian Africans.** The prevalence of chronic bronchitis in the African population of a small township in Rhodesia was estimated using two questionnaires, both based on those of the British Medical Research Council. The first, a screening questionnaire, was put to 9768 subjects aged 5 years and above and the second, a more detailed questionnaire, to random selections of these grouped according to their replies. Repeat interviews were used to assess the accuracy of the questionnaires. The overall prevalence of chronic bronchitis was 1·12%. This is much lower than most other surveys elsewhere. There was little evidence of an increase in prevalence with age, and rates were not significantly different in the two sexes. The prevalence of complications and of other chest symptoms was correspondingly low. The proportion of bronchitics who smoked was not significantly higher than in the controls. Amounts smoked, however, were generally much lower than in other populations, and this, together with low levels of pollution, probably account for the prevalence findings.

Chronic bronchitis is probably the most important pulmonary disease in the Western world, and the formulation of a definition (Ciba Foundation, 1959) and the adoption of the standardised questionnaires developed by the Medical Research Council (1960) has allowed comparison of its prevalence in many different countries.

Among developing countries, surveys have been performed in India (Joshi *et al.*, 1975), Papua New Guinea (Anderson, 1976), and in the Caribbean (Miller and Ashcroft, 1971), but there is very little information about the prevalence of this disease in Africa. Paul (1961) in Northen Rhodesia (now Zambia) asked a large number of male miners and non-miners 'whether or not they had a persistent cough with sputum', and Sluis-Cremer (personal communication) has surveyed certain occupational groups in South Africa with the MRC questionnaire.

To discover more about the importance of this disease in Africa, we have surveyed a total community using a modified MRC questionnaire and compared our findings with similar surveys elsewhere. The survey was also designed to determine the prevalance of asthma, but this report is confined to chronic bronchitis.

Methods

The population chosen was that of the main African suburb of Gatooma, a small town 80 miles (130 km) from Salisbury. This population is of moderate size, lives in a circumscribed area, and is reasonably representative of African urban society. The town had the disadvantage of being the centre of Rhodesia's cotton industry so care was necessary to record occupation. It is surrounded by farm land, and there are no important sources of pollution. The midday temperature for most of the year averages 25–30°C. During the short winter (May–July) night temperatures fall to near freezing, but the days remain warm.

QUESTIONNAIRES

Two questionnaires were used. The first was given to as many people as possible aged 5 years and over and the second to a random selection of these according to the methods described below.

[1]Present address: Groby Road Hospital, Groby Road, Leicester, UK

Both were based on the MRC (1966) questionnaire. The first (termed the short) questionnaire asked 11 screening questions about cough either first thing in the morning, or during the day, or at night, both in summer and winter; about sputum production; about shortness of breath when walking either on the level or up a slight hill; and about shortness of breath with wheezing either currently or in the past. The second and long questionnaire repeated the first and asked additional questions about duration of symptoms, chest illness, smoking, residence, and occupation. The short questionnaire attempted to identify all those with chest symptoms while the long was designed to identify chronic bronchitics. Translation was performed by the Department of African Languages of the University of Rhodesia. The results were shown to several African hospital interpreters, nursing sisters, and medical students, who suggested certain modifications to improve comprehension by persons with a limited education.

The short questionnaire was distributed by finding one member of each household and giving him enough forms for the whole family. The forms were filled in that night and returned the next day. Individuals were contacted through schools, places of work, and house visits. When explaining the project the importance of everybody (including perfectly fit persons) completing a form was stressed. Community leaders were approached first so that they would understand the nature of the project and could reassure others if asked.

As there was no clear pattern of positive replies to the short questionnaire, the 11 questions were combined into five groups; winter cough, summer cough, sputum production, shortness of breath, and wheezy breathlessness. A random sample was then taken from each combination of these groups (using random sampling numbers), taking higher percentages from those containing more symptoms. A control sample was also taken from those replying 'No' to all questions. As the first random selection from the 'Yes' group did not, in the event, provide enough chronic bronchitics for analysis, a further sample was taken later.

The long questionnaire was applied to all those selected in this way unless a subject refused or could not be traced when a substitute, if available, was taken from the same group. This questionnaire was administered by a single interviewer trained in the technique. He was a resident of the township, a trained laboratory assistant, and had previously conducted prevalence surveys in this township. The MRC's instructions on the use of the questionnaire were followed so far as they were applicable.

If replies to the questionnaires contradicted each other this was pointed out to the subject, who was then asked to choose the true state of affairs. He was not shown his replies to the short questionnaire before answering the long one.

DEFINITIONS

Chronic bronchitis was defined as a productive cough on most days for as much as three months each year. The MRC's questionnaire does not ask about duration in years because this is almost always for at least two years. This assumption could not be made in our study so an extra question was inserted, which showed that almost all subjects had indeed had symptoms for two years or more, so replies to this were ignored and conformity maintained with the MRC questionnaire. Subjects who also had variable wheezy breathlessness were considered to be asthmatic and were not included in the analysis.

A household member was any individual sleeping in that house on the night that it was surveyed.

A cigarette smoker was one who smoked at least one cigarette a day for as long as one year.

VALIDATION

Direct supervision of the interviewer was found not to be practicable, partly because of language difficulties and partly because the presence of an outsider was found to inhibit the procedure. Reliance was therefore first placed on detailed discussions with the interviewer both before and at intervals during the interviewing period. An African medical student, attached to the project for part of the time, was able to confirm that interviews were carried out consistently and correctly.

A further assessment was made by one of us (JBC), who re-interviewed and examined as many of those identified as chronic bronchitics as possible. This could not be an exact check as the subjects might change their minds, but it was considered that it would identify gross errors. Some discrepancies were found (described below), which were allowed for in the prevalence calculations.

LUNG FUNCTION TESTING

At this re-interview lung function testing was performed using a Godart 6-litre water spirometer to measure vital capacity (VC) and forced expiratory volume in 1 sec (FEV_1). Tests were administered by an African medical student trained in the technique. The procedure was explained to the sub-

ject who then practised it until proficient. Three recordings of each measurement were made and the best selected. Height (without shoes) was measured in centimetres and weight (in indoor clothing) in kilograms. Results were converted to BTPS. An attempt was made to perform these tests on the controls but few attended. Results were therefore compared with prediction formulae for Rhodesian Africans (Cookson *et al.*, 1976) drawn up in Salisbury.

PREVALENCE CALCULATIONS

The number of bronchitics identified by the long questionnaire was related to the group of the short questionnaire from which they were originally selected. Expected numbers were then calculated. The sum of these expressed as a percentage of the total population gave the overall prevalence rate.

Similar calculations were made to derive age specific prevalence rates and the prevalence of other symptoms elicited by the long questionnaire.

Significance testing was by the Chi-squared test using the fourfold table. P values less than 0·05 were considered significant.

Results

All houses in the suburb were surveyed, but 38 were unoccupied. A total of 9768 persons were contacted with the short questionnaire, of whom 9287 completed it in full. Incomplete questionnaires were received from 99, and 382 (4% of the total) refused. Occasionally, however, the head of a household would refuse on behalf of his whole family. Since we had no means of knowing the size of that family, the true number of refusals is rather larger.

Of those who completed a short questionnaire, 6970 answered every question in the negative. They will be termed the 'No' group. Of these, 340 were selected to receive the long questionnaire and this was actually completed by 282.

The remaining 2380 subjects replied 'Yes' to one or more questions. They will be termed the 'Yes' group. Of these, 941 were selected to receive the long questionnaire, and this was actually completed by 712.

The age and sex distribution of the population was derived from all those replying to the short questionnaire and compared with figures for the African population of Rhodesia as a whole taken from census returns (Central Statistical Office) (Table 1). There are more young men in the suburb, presumably because of employment opportunities, but fewer children and old people.

Table 1 *Age and sex distribution of the population surveyed compared with that of the African population of Rhodesia taken from census returns*

	Male subjects			*Female subjects*		
Age	*No.*	*%*	*Census %*	*No.*	*%*	*Census %*
5–9	739	13·5	20·9	763	20·0	21·3
10–14	837	15·3	16·3	816	21·4	16·5
15–19	593	10·8	12·2	551	14·5	12·4
20–24	513	9·4	8·8	442	11·6	10·8
25–29	690	12·6	8·1	387	10·2	9·1
30–34	618	11·3	7·4	313	8·2	7·5
35–39	544	9·9	6·6	210	5·5	6·4
40–44	370	6·8	5·0	146	3·8	4·4
45–49	247	4·5	4·8	90	2·4	4·2
50–54	143	2·6	3·5	39	1·0	2·5
55–59	84	1·5	2·5	17	0·5	1·7
⩾60	100	1·8	3·9	35	0·9	3·2
Totals	5478	100	100	3809	100	100

Altogether 287 people, though selected for the second questionnaire, did not complete it. In 273 cases this was because the subject had moved away from home and could not be traced. Seven subjects had died, and seven refused. To assess if chest disease was a factor in this migration, the percentage who moved away in the 'Yes' group (24%) was compared with that in the 'No' group (17%), since presumably the latter move for reasons other than their health. This difference is significant ($\chi^2=7{\cdot}61$, $P<0{\cdot}01$) suggesting that those with disease do indeed move away. As indicated above, however, a second random selection was necessary in the 'Yes' group, and this allowed more time for the natural migration of subjects.

The long questionnaire identified 48 bronchitics, all from the 712 subjects in the 'Yes' group. Only two subjects of the 282 in the 'No' group changed their minds and said that they did have symptoms. Many replying 'Yes' to the short questionnaire replied 'No' to the long, almost always because they had recorded mild transient symptoms on the first occasion. Thirty-six of these bronchitics were re-interviewed, 33 giving a history consistent with the long questionnaire. One claimed no symptoms, and two were considered to be asthmatic. Numbers were modified appropriately, and a correction factor applied to those not re-interviewed.

The prevalence rate for the whole population, calculated from these figures by the methods described above, was 1·12%. The prevalence in all those aged over 20 was 1·15% for men and 2·78% for women, and in those aged 40 and above 1·54% for men and 5·60% for women. Small numbers made further division by age not worthwhile and also meant that the greater prevalence among women was not significant in either group (over 20, $\chi^2=2{\cdot}75$, $P<0{\cdot}10$; over 40, $\chi^2=0{\cdot}13$, $P<0{\cdot}7$). Table 2 shows the prevalence of certain other

Table 2 *Prevalence of respiratory symptoms by age*

	Age 5–14		15–24		25–34		35–44		45–54		⩾55	
Symptoms	*No.*	%	*No.*	%	*No.*	%	*No.*	%	*No.*	%	*No.*	%
Males												
Winter cough	23	5·6	28	8·2	28	8·6	26	6·9	18	10·9	7	11·4
Prolonged* winter cough	16	2·8	12	1·9	14	3·3	17	3·3	13	5·6	7	11·4
Summer cough	14	2·7	20	4·8	26	5·5	25	4·6	20	9·9	7	11·4
Prolonged* summer cough	9	1·6	10	1·6	14	3·1	13	2·7	14	7·3	3	3·4
Winter and/or summer cough	24	5·8	32	9·7	31	9·1	28	7·6	19	11.2	8	12·0
Any sputum production	21	3·9	26	8·4	32	7·4	26	6·6	19	9.1	8	7·6
Winter sputum 'usually'	16	2·1	24	6·7	22	4·5	23	5·3	16	7.4	7	6·5
'Severe'† dyspnoea	2	0·4	4	0·7	9	2·2	9	3·6	7	3.3	3	2·6
Females												
Winter cough	30	6·7	19	6·4	15	6·7	12	11·4	4	8·1	3	40·4
Prolonged* winter cough	22	4·6	10	2·5	13	3·7	10	7·0	3	4·4	2	22·1
Summer cough	27	4·7	18	5·6	19	5·8	11	7·5	4	6·1	2	21·2
Prolonged* summer cough	16	1·7	8	2·4	12	3·5	8	6·0	2	2·4	1	2·9
Winter and/or summer cough	31	7·1	23	7·3	20	8·4	16	11·6	5	9·8	3	40·4
Any sputum production	27	4·7	17	5·1	17	7·6	11	6·3	5	9·7	3	40·0
Winter sputum 'usually'	24	4·5	14	4·5	15	7·1	11	4·6	4	8·0	3	40·0
'Severe'† dyspnoea	6	0·4	8	2·2	9	2·4	8	4·7	2	4·0	1	2·9

*On most days for as much as 3 months each year. †Stops for breath when walking at own pace on the level.

respiratory symptoms by age in male and female subjects. Symptoms are included regardless of the presence or absence of others; thus those with sputum production include those with chronic bronchitis. It will be seen that summer cough is much less common than winter cough and that the combination of winter and summer cough is only slightly higher than winter cough alone. This suggests that those who cough in the summer also cough in the winter and that there are not two syndromes, summer cough and winter cough. The combination cough and sputum does not appear as all those with sputum production also admitted to cough. There were too few subjects to calculate age-specific prevalence rates for chest illnesses (increased cough and sputum lasting three weeks or more in the past three years) or for moderate dyspnoea (shortness of breath when walking with other people of own age on the level). Of the 34 adult bronchitics, 12 had chest illnesses, five had moderate or severe dyspnoea, and three had both.

Table 3 shows the smoking habits of male bronchitics and control subjects aged 15 years and over. No subject smoked more than 25 cigarettes a day. There were no pipe smokers and no ex-smokers. The proportion of bronchitics who smoked (47%) was not significantly greater than for the controls (36%) ($\chi^2=0{\cdot}59$, $P<0{\cdot}5$). Only four women smoked—three controls and one bronchitic. The average age of onset of smoking was about 25 years.

Nine of the 15 male bronchitics who were re-interviewed and 56 of the 104 male control subjects, who were aged 20 years and over, had worked in a cotton factory. This difference is not significant ($\chi^2=0{\cdot}03$, $P<0{\cdot}9$). No women worked in these factories. There were no miners or ex-miners among the bronchitics.

Two men and one woman with bronchitis had an FEV_1 two SD below predicted normal values (Cookson *et al.*, 1976), and in two of these the FEV_1% was below 60.

Table 3 *Smoking habits of male bronchitics and controls aged 15 and over*

	Age 15–29	30–39	40–49	50–59	⩾60	*Total*
Male bronchitics						
Non-smoker	2	4	3		1	10
Cigarette smoker						
1–14/day	4	2		2	1	9
15–29/day						
Total	6	6	3	2	2	19
Controls						
Non-smoker	24	16	13	12	7	72
Cigarette smoker						
1–14/day	10	7	10	10	3	40
15–29/day			1			1
Total	34	23	24	22	10	113

Discussion

The two-stage technique used in this study enabled large numbers of subjects to be surveyed in a reasonable time at reasonable cost. Both self-administered and interview methods were used. Interviews are more usual, but three studies (McNab *et al.*, 1966; Pearl *et al.*, 1966; Lebowitz and Burrows, 1976) have used self-administered questionnaires with success. The interview technique is important, it being particularly necessary to keep to an agreed protocol and to establish criteria for a positive reply (Fletcher, 1956; Fairbairn *et al.*, 1959). In the present survey these points were met partly by detailed discussion before and during the interviewing period but mainly by re-interview of as many subjects with disease as possible. Surveys (McNab *et al.*, 1966; Pearl *et al.*, 1966) using a two-stage technique have found good correlations between the two questionnaires, but we found many fewer symptoms were reported on the long questionnaire. However only two subjects reported symptoms on this questionnaire but not on the first; thus the aim of the short questionnaire, to identify all those with chest symptoms, seems to have been largely achieved.

Questionnaires were kept as close as possible to that of the MRC for comparison with other surveys. The MRC questionnaires have been translated into many languages, but this was the first African one. This study confirmed Mork's (1964) view that translation should be performed not only by professional translators but also by those familiar with local medical idioms. Illiteracy was a possible problem but it appeared that those with a child at school had no difficulty and that others had a neighbour who customarily helped with such problems. Questionnaires are not yet a feature of daily life to the Rhodesian African and it was uncertain whether one would be acceptable at all. In fact the method seemed readily accepted by, and appropriate for, this population.

The definition used conformed to that of the Ciba Foundation (1959) symposium. No further requirement that dyspnoea or chest illness be part of the definition was made, although the questionnaire allowed for the calculation of both of these. The MRC proposal (1965) that a category of 'chronic mucopurulent bronchitis' be distinguished was not followed as collection and recording of sputum samples would have greatly complicated the organisation of the survey and would probably have reduced patient co-operation. Lung function testing, however, allowed calculation of the MRC's category of 'chronic obstructive bronchitis'. Definitions of chronic bronchitis exclude the presence of localised lung disease—such as bronchiectasis, the collagen diseases and pulmonary fibrosis, the pneumoconioses, primary cardiovascular-renal diseases, diseases of the chest wall, and psychoneuroses (Ciba Foundation, 1959). These are not usually formally excluded in surveys as their prevalence is thought to be too low to affect the overall conclusions. It was not certain that this would be true in Rhodesia, but radiography was not possible because of cost and lack of equipment. Clinical examination, however, would probably have identified most patients with these diseases.

Refusals are a difficult problem in this type of survey since such subjects may have a different pattern of disease than the remainder (Anderson *et al.*, 1963). The 4% refusal rate in this survey compares with rates varying from 0·84 to 25% in other large surveys (Fletcher and Tinker, 1961; Anderson *et al.*, 1965a). The low refusal rate for the second questionnaire (seven subjects) was very satisfactory. A serious problem was the large migration rate that occurred between the two questionnaires. In particular, the apparently higher rate in the 'Yes' group might be due to disabled persons returning home. The need to perform a further selection from this group probably explains this discrepancy however, although it is not possible to be certain. The low prevalence of bronchitis makes it unlikely that many return home because of chest disability.

To compare this study with others requires the use of age-standardised rates to avoid distortions due to differences in age structure. Table 4 compares rates in Gatooma with those in similar surveys elsewhere. Populations were standardised to that of Gatooma. It will be seen that the rates in Gatooma are very much lower than most surveys. Many early studies were confined to those aged 40 and over but there were too few bronchitics in Gatooma to make meaningful comparisons in this age group alone.

There was no indication of a dramatic increase with age, although this has been a feature of some British surveys (Higgins, 1957; College of General Practitioners, 1961; Reid *et al.*, 1974). The paucity of older subjects means that any such increase would not produce as many bronchitics as expected. This might partly explain the low prevalence in Gatooma but would not affect the international comparisons. Unlike this survey, all others have shown a pronounced male predominance.

The low rates in Gatooma are in keeping with other studies in Africa. A survey (Paul, 1961) in

Table 4 *Age-standardised prevalence rates of chronic bronchitis in Gatooma and in certain other similar surveys*

Area	*Age range*	*No. surveyed*	*Prevalence*		*Reference*
			Males	*Females*	
Gatooma	20+	4994	1·2	2·8	This study
Vale of Glamorgan, UK	25–74	581	13·9	10·1	Higgins (1957)
Berlin, New Hampshire, USA	25–74	1139	23·4	8·8	Ferris and Anderson (1962)
Tecumseh, Michigan, USA	20–79	4542	7·2	3·4	Payne and Kjelsberg (1964)
Glenwood Springs, California, USA	20–69	609	17·3	12·4	Mueller *et al.* (1971)
Chilliwack, British Columbia, Canada	25–74	557	20·7	12·9	Anderson *et al.* (1965b)
Uppsala, Sweden	30–64	41 679	2·2	1·5	Irnell and Kiviloog (1968)
Geneva, Switzerland	20–60+	1736	4·5	0·5	Rufener-Press *et al.* (1973)
Busselton, W. Australia	20–74+	3331	6·3	2·4	Cullen *et al.* (1968)
North India	15–64	473	12·7	—	Joshi *et al.* (1975)

Northern Rhodesia (now Zambia) found that 0·1% of 3536 miners and none of 1815 non-miners had 'persistent cough with sputum'. Sluis-Cremer (personal communication) in Johannesburg, South Africa, found a prevalence of 7·8% in male non-miners over the age of 35. They are also compatible with the low mortality figures recorded for Africans in Rhodesia (Rhodesia: Report of the Secretary for Health, 1975) and the rarity of necropsy evidence of emphysema found in Uganda (Jones and Madda, 1974). A genetic factor may be implicated as US negroes seem to have less bronchitis than whites (Murphy *et al.*, 1962; Coates *et al.*, 1965) and those of African descent living in the West Indies have less than those of Indian descent (Miller and Ashcroft, 1971). In Papua New Guinea Anderson (1976) has found a high prevalence of respiratory symptoms and signs with smoking playing a significant part. Methods are too different however to allow closer comparisons.

A striking feature of the Gatooma males was that although about 40% smoked, the bronchitics did not smoke significantly more than those without symptoms. This is in contrast to all other work in this field, which has shown a close relationship with smoking. Larger numbers might have shown a correlation, but an alternative explanation is that the Gatooma subjects did not smoke sufficiently to cause an effect, almost all smoking less than 15 cigarettes a day. In addition, the average age of starting smoking was 25 years. Surveys in Britain and North America of the smoking habits of whole populations have shown much higher levels and an earlier start. Fletcher and Tinker (1961) in Britain found that 43% smoked between one and 14 cigarettes a day and 32% smoked more. Comparable figures by Holland and Stone (1965) in the USA were 9·6% and 61·9%. Smoking between one and 14 cigarettes a day seems to lead to only modest increases in bronchitis prevalence (Higgins *et al.*, 1956; Higgins, 1957; Coates *et al.*, 1965). The conclusion that smoking these amounts has little influence on bronchitis rates in Gatooma is supported by the findings in women, who have a similar prevalence to men but hardly smoke at all.

Pollution factors would appear unimportant in Gatooma, although no direct measurements have been made; neither could an important relationship to exposure to cotton dust be established.

We conclude that the prevalence of chronic bronchitis in this population is strikingly low. This may be due to a low consumption of cigarettes and low pollution levels.

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Requests for reprints to: Dr. J. B. Cookson, Groby Road Hospital, Groby Road, Leicester, UK.