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Prevalence of asthma in Rhodesian Africans

J B COOKSON AND G MAKONI

From the Department of Medicine, University of Rhodesia, Salisbury, Rhodesia

ABSTRACT The prevalence of asthma in a small African town has been assessed using two questionnaires. The first was put to 9768 subjects aged 5 years and older and the second, more detailed, questionnaire to random selections of these subjects grouped according to their replies. The overall prevalence of asthma was 1·40%. In those under 20 years of age it was 1·20% and in adults, 1·57%. This adult rate is similar to those in developed countries but that in children is lower. The relative paucity of childhood asthma is compatible with the suggestion that infestation with parasites may protect against the disease.

There have been many prevalence studies of asthma in developed countries, but little has been recorded from the rest of the world. Most evidence available suggests that asthma, particularly childhood asthma, may be uncommon in some underdeveloped countries. For example, a population survey in the New Guinea Highlands[1] found no asthmatics under the age of 10 years, and childhood asthma is rare among hospital attenders in South Africa,[2] Nigeria,[3] and Kenya.[4 5] None was found in a survey of 191 children in the Gambia.[6] Asthma is less common in immigrant children in Birmingham than in the native-born.[7] Childhood asthma seems common, however, in Barbados[8] and Cuba[9]. Adult asthma is recognised without difficulty in hospital studies in these countries.

These differences are of more than local interest because some populations in underdeveloped countries may have high IgE levels caused by parasitic infection. This "non-specific" IgE might block mast cell receptor sites and prevent "specific" (anti-allergen) IgE from occupying those sites. Subsequent contact with allergen would not then lead to release of vasoactive substances from the mast cell.[10] To begin to assess this hypothesis we have determined the prevalence of childhood and adult asthma in a large scale population survey in an African township in Rhodesia. The survey was also designed to assess the prevalence of chronic bronchitis, but this report is confined to asthma.

Address for reprint requests: Dr JB Cookson, Groby Road Hospital, Groby Road, Leicester.

Methods

The population studied was that of the African suburb of Gatooma, a small town 80 miles (130 km) from Salisbury. This has a stable population of reasonable size (approximately 15 000) in a small area with a good cross-section of African urban society. A disadvantage was that a major local employer is the cotton industry so care was necessary to document employment. Most families maintain close contact with their homes in rural areas.

The survey used two questionnaires, both in the local African language (Shona). The first asked 11 screening questions about cough, sputum production, dyspnoea, and wheeze, and was put to as many people aged 5 years and over as possible. The second was based on the Medical Reseach Council's questionnaire. It was put to random selections of those replying to the first questionnaire, grouped according to the pattern of their replies, so as to take a higher percentage from those groups with the most symptoms. A control sample was taken from those replying "no" to all questions. This questionnaire repeated all the first and asked additional questions about duration of symptoms, smoking, occupation, and residence, and in particular "does your chest ever make noises when you breathe" and "have you ever in the past had attacks of shortness of breath with noises in the chest." A positive reply to either was followed by "is this sometimes better, sometimes worse, or the same all the time." A reply of variability was taken to indicate asthma.

The first questionnaire was distributed by households by contacting one member of each household (through schools, place of work, and home visits) and giving him enough forms for the whole family. These were given out one day, filled in that night, and returned the next day. The second questionnaire was administered by a single interviewer.

Direct supervision by one of us (GM) was possible for part of the interviewing period. As a further check the other reinterviewed as many as possible of those identified as asthmatic. At this time those working in cotton factories were also asked if they were worse on any particular day of the week and also skin tests to 17 common allergens were performed by the prick method using Bencard allergens. Wheal diameters at least 1 mm greater than the control were considered positive. Most had blood eosinophil counts performed. A Godart six-litre water spirometer was used to measure vital capacity (VC) and forced expiratory volume in one second (FEV_1). Results in adults were compared with prediction formulae drawn up for this population.[11]

Asthmatics identified by the second questionnaire were related to the group of the first questionnaire from which they were originally selected. Expected numbers in each group were then calculated. The sum of these, expressed as a percentage of the whole population, gave the overall prevalence rate. Similar calculations were made to derive age-specific rates.

Results

In all, 9768 people were contacted with the first questionnaire. Completed questionnaires were received from 9287 subjects, incomplete from 99 subjects, and 382 subjects (4% of the total) refused to take part. Occasionally, however, the head of a household would refuse on behalf of his whole family. As the size of the family was unknown the true refusal rate is rather higher.

Of the completed questionnaires, 6902 answered no to all questions. Of these, 340 subjects were selected to receive the second questionnaire and this was actually completed in 282. The remaining 2380 subjects replied yes to one or more questions: 941 were selected for the second questionnaire and 712 completed it. The age and sex structure of the population derived from the first questionnaire was compared with that of the population of Rhodesia as a whole (table 1). There are more young males in the suburb than would be expected, 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*

Age (yr)	Males Number	%	Census %	Females Number	%	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

Not all those selected for the second questionnaire received it. Seven died and seven refused. The remaining 273 had moved and could not be traced. Significantly more subjects had moved in the yes group (24%) than the no group (17%) ($\chi^2=7{\cdot}61$, $p<0{\cdot}01$) suggesting that they might have moved because of ill health. However, a second selection of the yes group was necessary as insufficient asthmatics were identified on the first occasion. This took longer and would have allowed more time for natural migration to occur in this group.

Eighty-three asthmatics were identified according to the criteria adopted, all from the yes group. Only two subjects from the no group changed their minds and admitted to chest symptoms. Fifty-seven people were interviewed and most gave a history consistent with the questionnaire. One, however, claimed no symptoms, four had referred to a single episode a long time previously, one had cardiomyopathy, and one tuberculosis. Those with symptoms of chronic bronchitis were interviewed concurrently and two were considered to be asthmatic. Numbers of those interviewed were modified appropriately and the same proportionate change was applied to the 26 who were not interviewed. Calculation of the prevalence was based on these adjusted figures.

The overall prevalence rate derived from these final figures was 1·4%. In those under 20 years the rate was 1·2%, and in adults, both male and female, 1·6%.

Of the 52 people in whom the diagnosis was confirmed 32 were male and 20 female. Their age range was from 5 to 66 years, with a mean of 30·3 years. The age of onset of symptoms varied

from under 1 year to 59 years, with a mean of 25·6 years. Thirty-four people (65%) gave a history of house-dust sensitivity and 35 (67%) were worse during the rainy season. Twenty-seven people (52%) had positive skin reactions to *Dermatophagoides pteronyssinus,* 19 (37%) to grass pollen, 14 (27%) to tree pollen, 15 (29%) to shrub and flower pollen, 20 (38%) to cat dander, 18 (35%) to dog dander, and smaller numbers to a variety of other allergens. The mean blood eosinophil count in the 49 subjects in whom it was performed was 179 cu mm. Four counts were greater than 400 cu mm.

Of the 29 adult males, 13 worked in cotton factories. Eight claimed that symptoms were sometimes worse on Mondays, but all also had symptoms at weekends. No females worked in these factories.

Six adults had an FEV_1 two standard deviations below predicted values. Two children had an FEV_1 below 60% predicted.

Discussion

Most prevalence studies have used questionnaires asking either about asthma directly or, like this study, about variable wheezy breathlessness. Our two-stage technique enabled large numbers to be surveyed with reasonable ease and economy. The method appeared easily understood by, and appropriate for, this population.

Definitions of asthma remain unsatisfactory. Some objective measurement of variability in airway obstruction is often recommended[12] but is difficult to apply in prevalance surveys. Further, both exercise and histamine, and methylcholine induced bronchospasm, though characteristic, are not universal.[13-16] Tests for blood, sputum, and nasal eosinophilia may be negative, especially in remission.[17 18]

Table 2 contains a comparison of age-standardised rates for adult asthma in this and other similar surveys. Populations are standardised to that of Gatooma. Some definitions are "cumulative", including all with a past history of asthma; some are "current". Some ask specifically about asthma —here the diagnosis is considered "definite"; some only, or in addition, ask about wheezy breathlessness where it is considered "probable". This survey is "cumulative" and "probable", but as memory for past events is often poor it is unlikely to have recorded much quiescent disease. Such considerations make comparisons difficult. Rates are much lower than for the only other "cumulative" and "probable" survey, but are little different from the remainder. This is in keeping with clinical studies in Africa, adult asthmatics having been readily identified in Nigeria,[3 25] Ghana,[26 27] the Gambia,[6] Kenya,[4 5 28] Zambia,[29] and by ourselves in Rhodesia.[30]

Table 2 *Age-standardised prevalence rates of asthma in adults in Gatooma and in certain other similar surveys*

Area	*Definition (see text)*	*Number surveyed*	*Prevalence (percentage)*		*Reference*
			Males	*Females*	
Gatooma	Cumulative and probable	4994	1·6	1·6	This Study
Tecumseh, USA	Cumulative and probable	5465	12·3	11·4	19
Uppsala, Sweden	Current and probable	41 679	2·2	2·1	20
Colorado, USA	Cumulative and definite	609	3·6	1·2	21
Nationwide, USA	Current and definite	133 132	2·6	2·8	22
Chilliwack, Canada	Current and definite	557	1·5	0·7	23
Israel	Current and definite	22 338	0·6	0·6	24

Table 3 shows rates in children. All definitions are "cumulative" and "probable". Rates in Gatooma seem to be considerably lower than in other developed countries. This again is in keeping with most other studies in Africa. No asthmatic children were found in a prevalence survey in the Gambia,[6] and clinic studies elsewhere report very few children.[25 28 29] A recent report[33] from South Africa gives a prevalence of 0·14% for rural African children. In our clinic the youngest patient seen was aged 9 years and the average age of onset of symptoms was 26·8 years,[30] and this in a population of predominantly extrinsic asthmatics. Recently, however, Carswell and others[34] have reported contrasting findings from rural Tanzania. They surveyed 242 schoolchildren with a questionnaire and exercise testing. Nineteen asthmatics were found, giving a prevalence of 7·8%. They

Table 3 *"Cumulative" prevalence rates of asthma in children in Gatooma and in certain other similar surveys*

Area	*Age range (yr)*	*Number surveyed*	*Prevalence (percentage)*	*Reference*
Gatooma	5–19	4293	1·20	This survey
Birmingham, UK	5–18	20 958	9·9	7
Aberdeen, UK	10–15	2511	11·5	31
Tecumseh, USA	5–15	2595	12·5	19
Melbourne, Australia	7–10	30 000	11·4	32

find that these results are similar to those in Birmingham,[7] Aberdeen,[31] and Melbourne[23] but the figures taken from these studies all relate to different definitions from the one they have used. Parasites were equally common in asthmatics and controls suggesting that no protection was being exerted. However, exercise bronchoconstriction, though significantly greater than in the controls, was modest, and IgE levels and skin test reactions in the asthmatics were not significantly different from the controls. The possibility exists that not all these subjects were asthmatic, or at least atopic.

Allergy evaluation of our subjects suggested that the house-dust mite was an important precipitant, although this was not so striking as our clinical studies[30] where almost all were sensitive to this allergen. Some cotton workers were worse on Mondays but all had symptoms at the weekends as well. If they had byssinosis severe enough to cause weekend symptoms one would expect many more subjects to have symptoms confined to early in the working week. Cotton probably aggravates rather than causes symptoms in these subjects.

We appear to have demonstrated a low prevalence of childhood asthma in this suburb, a finding compatible with the suggestion that parasite infestation may protect against asthma. The expected high rate of parasitisation has been confirmed in this area of Rhodesia.[35] We have previously produced evidence[36] from this country supporting this theory in finding non-asthmatics with high levels of both total and allergen-specific IgE. The former perhaps blocks the effects of the latter. A further survey in a rural area would be of interest though one of this size would be extremely difficult in a scattered rural community.

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