

Prevalence of asthma: a comparative study of urban and rural Xhosa children

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Summary

An epidemiological study was undertaken to determine the prevalence of asthma in young urban and rural black (Xhosa) children. One thousand three hundred and seventy five children were studied, 694 from a Cape Town african township and 671 from a rural area in Transkei. The exercise tolerance test which required free range running at maximum effort for 6 min was used to identify asthmatic subjects. A fall of 15% or more in the post-exercise FEV₁ and PEFR values was regarded as a positive result. Twenty-three children were found to be asthmatic, twenty-two from the city area, but only one from the country, giving a prevalence figure for asthma of 3.17% in the first group and 0.14% for the second. Possible reasons for these differences are discussed.

The exercise tolerance test was found to be a useful tool for epidemiological studies of asthma.

Introduction

Several studies have been undertaken to determine the prevalence of asthma in childhood, and a wide variety has been reported in different population groups. Figures from studies in the United Kingdom, United States of America and Australia are similar, varying between 2 and 5%. Arbeiter (1967), Dawson *et al.* (1969), Graham *et al.* (1967), Nathanson & Rhyne (1970), Smith (1976), Williams & McNicol (1969).

In African and other non-industrialised countries, childhood asthma appears to be rare, with a reported prevalence varying between 0.007 and 1.96%. Analysis of these reports suggests that asthma is rare in rural communities at all ages. However, in urbanised areas, asthma is said to be common, with the greatest onset in the second and third decade (Buchanan & Jones, 1972; Godfrey, 1975; Mitchell, 1970; Viswanathan *et al.*, 1966; Warrell *et al.*, 1975).

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At the Red Cross War Memorial Children's Hospital in Cape Town only about 1% of the 3500 children attending the Allergy Clinic are black (Van Niekerk *et al.*, 1977). Wesley, Clyde & Wallace (1969) have also reported a very low incidence of asthma in black children in Durban, South Africa.

The vast majority of black children seen at our hospital are of the Xhosa tribal group who originate in the Ciskei and Transkei areas of South Africa. In order to ascertain whether asthma was as rare a disorder in the black children of our city as we suspected from our clinical experience, a study of urban and rural Xhosa children was undertaken to determine the prevalence of asthma in these two groups.

Material and methods

Selection of children

Xhosa children from 6 to 9 years old who appeared healthy and with no clinical evidence of mental or physical handicap were included in the study. Particular care was taken to exclude cases with known tuberculosis. To be eligible for inclusion, a child had to have been resident in the designated area for the previous 4 years or more.

The urban sample

Guguletu, a Cape Town township for blacks, was chosen for the purpose of the study. It is situated 22 km from the centre of Cape Town (latitude 33°55'S, longitude 18°28'E) on a flat plain. Cape Town is a coastal city with Mediterranean climate. The township consists of 7376 brick houses with corrugated iron roofs in an area of 627 ha and has 55,704 inhabitants. It has the facilities of a western style industrialised community such as shopping centres, cinemas, playing fields, schools and clinics.

Each house is identified by a number and street name. From these a random sample of 1300 houses was selected. All children fulfilling the selection criteria were included in the study which resulted in a final sample of 694 children from 416 families, comprised of 324 boys and 370 girls (ratio, 1:1.14). More than 95% of the children had lived in Guguletu since birth.

The rural sample

This consisted of children living within a radius of 9 km of St Cuthbert's Mission in the Tsolo district, Transkei. The mission is situated among the rolling grasslands of rural Transkei (latitude 31°19'S, longitude 28°39'E). The local people live in small communities of variable size, with families living in their own dwellings. These have walls of mud bricks with thatched roofs and earthen floors covered with stamped-down cow dung. A small number of the houses are built of cement bricks with corrugated iron roofs. No homes in the area have running water or electricity. The Tsolo district is situated 1100 m above sea level and has a summer rainfall. St Lucy's Hospital is situated at the Mission. Apart from providing for the health and spiritual needs of the community, it has not greatly influenced the life style of the people who still largely maintain their traditional tribal way of life.

The nearest town, Tsolo is 14 km distant and is reached by gravel road, while Umtata, the capital of Transkei is a further 51 km away. Contact with these towns is maintained by a bus service. It is a sparsely populated part of the country (ten to nineteen persons/km²). In order to obtain a comparable sample for the study, all children aged 6 to 9 years in the designated area were included.

The final sample consisted of 671 children from 459 families. There were 311 boys and 360 girls (ratio, 1:1.16). More than 97% of the children had been in the area all their lives.

Method of identification of asthmatic subjects

The exercise challenge test was selected as the most reliable single test for identifying children with asthma. The children were studied in small groups and each child was instructed in the technique of using the Wright Peak Flow Meter and of blowing on a Vitalograph. Once a child had achieved a satisfactory technique, pre-exercise readings of the forced expiratory volume in one second (FEV₁) using the Vitalograph, and peak expiratory flow rates (PEFR) using the Wright Peak Flow Meter were made. Each child was then required to run on the level in the open for 6 min at maximum effort. The pace had to be sufficient to raise the heart rate to 170 or more beats/min. Following this, readings of both FEV₁ and PEFR were obtained between 3 and 5 min after exercise had been completed. The best of three forced expirations was taken as the reading on the Peak Flow Meter.

The percentage fall post-exercise was calculated as follows:

$$\frac{\text{Pre-exercise FEV}_1 - \text{Post exercise FEV}_1}{\text{Pre-exercise FEV}_1} \times 100$$

Similar calculations were carried out for the PEFR. A drop of 15% or more in either FEV₁ or PEFR was regarded as diagnostic of exercise-induced asthma.

Informed consent was obtained from the parents or lawful guardian of each child in the study by Xhosa speaking nurses who visited the homes of each child and explained what it was intended to do. The period of study was from 1 April to 31 August, 1976.

Results

We report only findings of the children diagnosed as having asthma by the exercise technique.

(1) A diagnosis of asthma was made in twenty-two of the urban children (Guguletu) and in one child from the rural area (Transkei). The prevalence among Guguletu children was 3.17% and for children from the Tsolo district, 0.14%.

(2) The urban childrens' ages, sex and percentage drop in FEV₁ and PEFR are shown in Table 1, as are the figures for the single child from the Tsolo district. The mean percentage fall in the FEV₁ readings for the twenty-three children was 32.2%. For the remaining 660 children in Guguletu and 663 in Tsolo in which FEV₁ readings were made the mean change was a rise of 0.80% in Guguletu and a fall of 0.26% in Tsolo. In the case of PEFR, the numbers were 664 and 667 respectively with a mean fall of 0.25% in Guguletu and a mean of 0.17% in Tsolo. None of these changes differed significantly from 0.

(3) The sex ratio of boys to girls in the Guguletu children with asthma was 1:1.75.

Discussion

There is at present no single universally accepted definition of asthma (Porter & Birch, 1971), nor is there a single pathognomonic feature, physical sign or laboratory finding in this condition.

The diagnosis is usually based on a searching history and the evaluation of the entire clinical picture, relevant investigations and laboratory findings.

Table 1. Drop in post-exercise FEV₁ and PEFR in children with asthma (%)

	Age	Sex	FEV fall (%)	PEFR fall (%)
Guguletu	6	M	15.8	17.2
	6	M	51.0	50.0
	7	M	16.6	22.9
	8	M	26.1	25.6
	8	M	44.0	36.8
	9	M	25.0	18.8
	9	M	20.3	22.2
	9	M	25.8	50.0
	6	F	68.8	53.1
	6	F	23.5	33.3
	7	F	61.1	48.5
	7	F	28.6	19.2
	7	F	28.6	21.9
	7	F	18.5	15.9
	7	F	38.5	50.0
	7	F	16.7	15.4
	7	F	37.5	30.0
	7	F	35.0	20.0
	8	F	20.8	29.5
	8	F	32.1	57.7
	9	F	66.1	66.7
	9	F	35.0	20.0
		Mean	32.7	32.2
Tsolo	7	F	17.0	15.4

Guguletu children only: FEV₁: $n=22$; $\bar{x}=33.4$; s.d. = ± 15.9 ; s.e. mean = ± 3.4 ; PEFR: $n=22$; $\bar{x}=32.9$; s.d. = ± 15.8 ; s.e. mean = ± 3.4 .

Chai *et al.* (1968), found the validity and reliability of the history in the measurement of asthma to be of a low order and when studies are undertaken in populations necessitating the use of an interpreter, the limitations of the history become even greater. In many African communities the word for 'wheeze' or 'asthma' does not exist.

Exercise induced asthma has been designated the 'hallmark of asthma', Godfrey (1974), and Jones *et al.* (1963), have stated that failure to elicit wheezing or broncho-spasm with an appropriate exercise stimulus should lead to serious questioning of the diagnosis. While not all asthmatic children will develop exercise induced asthma if subjected to a single exercise, about 80% will do so after free-running for the correct period of time at maximum effort (Anderson *et al.*, 1975). The limitation of this test is that not all asthmatic children in a sample will be identified following a single exercise stimulus. The effect of this on the prevalence is minimal. The mean percentage fall in FEV₁ and PEFR for the twenty-three asthmatic children was very similar in this study as was the individual child's drop for both indices (Table 1). A drop in both FEV₁ and PEFR was used to identify the asthmatic child so as to eliminate any child whose fall in post-exercise levels might be of a technical nature. The exercise test was found to be a very useful technique in this epidemiological study.

A number of epidemiological studies have been done in many parts of the world to establish the prevalence of asthma. Reported rates in childhood show wide variations, but most of these studies were based on purely clinical criteria. Most studies are on adults and unproved statements regarding childhood asthma are often made.

Striking differences have been found in the prevalence of asthma in communities living in urban and rural regions in Africa and in other tropical and underdeveloped areas. Usually there is an almost complete absence of cases in the country districts (Anderson, 1974; Viswanathan *et al.*, 1966; Warrell *et al.*, 1975).

The low frequency of asthma in some children is not confined to Africa. A prevalence of 0.18% was found for children living in the urban area of Patna in India (Viswanathan *et al.*, 1966), while Pearson (1973), reported a frequency of 1.06% for asthma in children living in Barbados. Anderson (1974) found childhood asthma to be exceedingly rare in the rural areas of New Guinea with a calculated prevalence of 0.007%.

Epidemiological studies of asthma in industrialised countries have not revealed any difference in the prevalence for children living in urban compared to rural communities. In a study of 1760 rural Iowa families (Smith & Knowler, 1965), the prevalence of asthma for the total population of adults and children was 3.7%. This is comparable to that reported elsewhere in the United States.

The prevalence of 3.17% for asthma in the urban children from Guguletu in this study is comparable to those reported from western countries, whereas the low prevalence of 0.14% for asthma in the rural Tsolo district children compares with the reports from other parts of Africa, India and tropical countries. The difference in prevalence between the urban and rural samples may be due to an alteration in the way of life of the Xhosa people from their traditional tribal pattern to a western urbanised society. Such a change in life style might be responsible for the increase in the prevalence of asthma. Some of the changes include sleeping on beds with mattresses instead of on well aired mats which are not infested with the house dust mite. There is also a shorter period of breast feeding with an earlier introduction of cows' milk in the cities.

Are the differences in prevalence rates for children from urban and rural areas genetic or racial in origin? This is unlikely as African children have the same tendency to develop asthma as Caucasian children. Smith (1973) found asthma to be more common in black children who were born in the United Kingdom of immigrant parents than in the indigenous white children. However, black children born in West Africa and the West Indies and emigrating to the United Kingdom had a low prevalence of asthma and associated atopic disorders which he attributed to a lesser allergenic bombardment in their home countries.

It would seem that residence in an urban or rural environment in western industrialised communities does not influence the prevalence of asthma. In the less advanced societies however, asthma is found mainly in urban communities and there appears to be a striking absence of asthma in the rural environment. Whether this is due to alteration of life style or the possibility that the rural traditional way of life exerts a protective effect in the prevention of asthma is not clear at this stage.

We are unable to explain why so few asthmatic black children attend the Allergy Clinic at our hospital. If there is a prevalence comparable to that of other population groups, one would expect a much higher attendance figure than 1.12%.

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