

Allergic asthma in different population groups in the western Cape

Causative and complicating factors

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Summary

Allergic asthma is a disease with a well-defined aetiology, the recognition and elimination of which could be achieved with relatively simple and inexpensive prophylactic treatment. Some of the well-known factors — respiratory tract infections, exposure to cigarette smoke, specific antigens and regular application of prophylactic treatment — which could cause or complicate asthma were studied in groups of white and coloured patients. More respiratory tract infections occurred in coloured patients and they were more exposed to their own and secondary cigarette smoke. Pets and grass pollen allergenicity was more common among whites while allergy to *Aspergillus fumigatus* and *Ascaris lumbricoides* was found more frequently among coloured patients. Both white and coloured patients had problems with regular prophylactic control of their symptoms with inhaled β -stimulants, even after an average of two education sessions per patient, but this was of greater dimension for the coloured (60%) than the white group (27%) ($P < 0.001$). It is not possible to separate causative from genetic factors when studying asthma in different population groups, but recognition of prevailing causative factors for each group could stimulate an educational approach aimed at control by prevention rather than treatment of acute attacks.

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The western Cape with its temperate climate, prevailing winds, high rainfall and rich endowment with an extremely large variety of flora is a natural endemic area for allergic asthma. The prevalence of asthma in the northern suburbs of Cape Town has been reported to be 10% in the white population; this is high compared with figures from other countries.¹ A similar study has not been conducted among the coloured population group of the same region, but acute asthma is a major reason for emergency admission to the Department of Internal Medicine at Tygerberg Hospital. During a 6-month period 15.2% of 2469 non-white medical admissions were due to acute asthma compared with 3.2% of 622 white admissions.

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In the RSA numerous cultures and a wide range of socio-economic development are represented. The causative agents and complicating factors for allergic asthma could differ considerably between population groups, recognition of which could influence therapeutic decision-making in patients of Third-World development among whom little is known concerning aetiological factors. Problems which complicate the treatment of severe asthma and which could be present in varying degrees in different population groups are the tendency to upper and lower respiratory tract infections, specific sensitivity to environmental antigens, exposure to cigarette smoke and inability to use prophylactic treatment effectively. Studies conducted in Europe and the USA have shown that viral bronchial infections in adult asthmatics constitute a significant factor in exacerbations of airways obstruction.^{2,3} The role of repeated respiratory tract infections as an aggravating factor in allergic asthma was therefore determined in white and coloured groups of asthmatics. *Ascaris lumbricoides* has been proved to be a potent stimulus for IgE production in non-white patients in the western Cape with subsequent enhancement of the allergenic response to common inhaled allergens.^{4,5} Antigenic responses to common inhaled allergens were determined in white and coloured patient groups for the purpose of educating specific patients on antigen avoidance.

Active cigarette smoking or secondary exposure from the immediate environment can represent a major aggravating factor for allergic asthmatics since it inhibits aspects of lung function which are already severely impaired in asthma.^{6,7} In the present study this factor was evaluated in both population groups and found to be significant in coloured patients.

Inability to use inhaled treatment has proved to be a major stumbling block in effective prophylaxis of asthma.^{8,9} An objective of the present study was to determine how effectively inhaled preparations were used prophylactically in white and non-white groups. Statistical differences were evident for each of these areas of study and gave some insight into the factors which complicate the long-term treatment of asthma. A change in these practical matters could contribute to the successful preventive treatment of allergic asthma.

Patients and methods

All patients with allergic asthma, as defined below, between the ages of 12 and 40 years who attended the Allergy and Lung Immunology Clinic at Tygerberg Hospital between 1 January and 30 June 1985 were included in the study. A group of 55 white and 63 coloured patients who live in the western Cape region were included. Patients with a history of wheezing were evaluated by means of a questionnaire. Questions pertaining to the correct diagnosis, severity of the disease and contributing factors were classified as of major or minor importance in relation to the relevant issue. Patients with a history of wheezing were defined as asthmatics if symptoms started before the age of 35 years, were accompanied by allergic rhinitis (blocked nose, sneezing and chronic post-nasal drip) or when exercise bronchospasm was present (all major points). Seasonal occurrence of symptoms and a family history of asthma were considered points of minor impor-

tance. Patients with a history of wheezing in whom two major points or one major and two minor points were present were included as asthmatics.

Severity of asthma

Patients in both population groups were divided into severe and moderate asthmatics on the basis of the following criteria. Serious asthma was defined by means of the permanent use of oral corticosteroids, depletion of 2 or more bronchodilator refills per month, loss of 4 or more work- and school-days per year and 2 or more hospital admissions per year. Patients were characterised as having severe asthma if 2 or more of these features were present.

Contributing factors

Repeated infections

This was evaluated with reference to the following criteria: major features were more than 4 attacks of bronchitis per year as evidenced by cough with production of yellow sputum and/or the use of antibiotics more than 4 times per year for diagnosed bronchitis. Fever and periods of complete normality between attacks without dyspnoea were documented, but not included as essential criteria. The age range of 12-40 years was selected to exclude patients with chronic bronchitis. It was considered a contributing factor when a history of cough and sputum production for more than 3 months of the year was present. Asthmatics with this history were documented separately from those with repeated attacks of acute infection.

Role of cigarette smoke

The importance of smoking was investigated by means of the following points: if patients were current smokers, if they had smoked in the past and stopped or if someone was exposed to cigarette smoke at close proximity at home or at work for several hours per day. Any one of these factors was considered to be evidence of direct or indirect exposure to smoking and to contribute to the patient's disease.

Problems with the correct use of prophylactic therapy

This was evaluated by means of the following criteria: drugs were inadequate (prescriptions not renewed) or medicines were used only on demand (or never). All patients were requested to demonstrate their ability to use inhalers. Patients were questioned about the number of practical demonstrations and teaching sessions on the use of inhalers and prophylactic treatment in which they had participated. Problems of inadequate prophylactic therapy were diagnosed when prophylactic treatment was not used as prescribed or when hand-mouth inco-ordination with inhalers was evident.

Special investigations

Skin-prick tests

Skin-prick tests were performed with Bencard antigen solutions. They were interpreted by an experienced sister and corrected skin wheals of no less than 4 mm diameter were considered as positive reactions. House dust, house-dust mite, grass pollens, cat and dog dander, and *A. fumigatus* and *A. lumbricoides* were selected as they represent the common positive reactions in the Allergy Clinic records. Statistical analysis was carried out to identify the presence of specific antigen sensitivity in the two population groups. Radiographic examination of the chest was carried out and all radiographs were evaluated by two senior staff members. Specific attention was paid to the radiological changes suggestive of bronchiectasis, enlargement of the heart and fibrotic lesions suggestive of previous tuberculosis. Serum total IgE levels were determined by the paper radio-immunosorbent test.

Lung function tests

Screening lung function tests were done and for the purpose of this study the following values were selected: (i) forced expiratory volume in 1 second (FEV_1) expressed as a % of the vital capacity (VC), values less than 80% predicted were regarded as abnormal; (ii) residual volume (RV) expressed as % of the total lung capacity (TLC), values greater than 120% of predicted normal were considered abnormal; and (iii) area under the expiratory flow volume curve (AV/VE). Values of this composite determination of lung function of less than 80% of predicted were regarded as abnormal.

Statistics

Information was processed on an Apple microcomputer. In comparing the different population groups, non-parametrical statistics including the Spearman rank-correlation and Mann-Whitney *U*-tests were used.

Results

Race and sex distribution

The 118 patients in the study group comprised 23 white males, 32 white females, 19 coloured males and 44 coloured females.

Degree of severity

Severe asthma was by definition present in 10 white males and 15 white females (45% of total population group). A similar estimation of severity was present in 8 coloured males and 21 coloured females (46% of total sub-group). There was thus no significant difference between the race groups as regards severity of asthma.

Contributing factors

Recurrent infections

Repeated acute bronchitis was a factor in 22% of the white male and 44% of the white female patients. In the coloured patient group 53% of the males and 61% of the females manifested this factor. Recurrent infections were present in a total of 34% of whites as opposed to 59% of coloured patients ($P < 0,01$).

A history of chronic bronchitis as a possible contributing factor to the syndrome of obstructive airways disease was present in only 2 white males, 2 coloured males and 2 coloured female patients.

Cigarette smoking

This was a possible contributory factor in 86% of the coloured as opposed to 56% of white patients ($P < 0,01$). As regards the nature of exposure obvious differences were found in all three categories between the two race groups (Fig. 1). Secondary exposure at home or work was present in 45,5% of white as opposed to 70% of coloured patients ($P < 0,001$). In the white population group 4% of patients and in the coloured group 14,3% were still active smokers ($P < 0,01$). There was a history of previous smoking in 22% of the white and 44% of the coloured groups ($P < 0,001$).

Inadequate prophylactic inhalation therapy

In the coloured population group 60% had a problem with regular prophylactic inhalation treatment compared with 27% of the white group. Analysis of the reasons for inadequate prophylaxis in the two groups revealed that 49% of coloured patients and 22% of the white patients used the prophylactic treatment on demand only ($P < 0,01$). In spite of at least 2 practical demonstrations per patient, 35% of coloured patients and 11% of white patients could not use the inhaler correctly ($P < 0,001$). Furthermore, 17% of the coloured patients opposed to 5% of white patients who required regular inhaled prophylactic treatment failed to renew drugs regularly on depletion of their supply ($P < 0,01$).

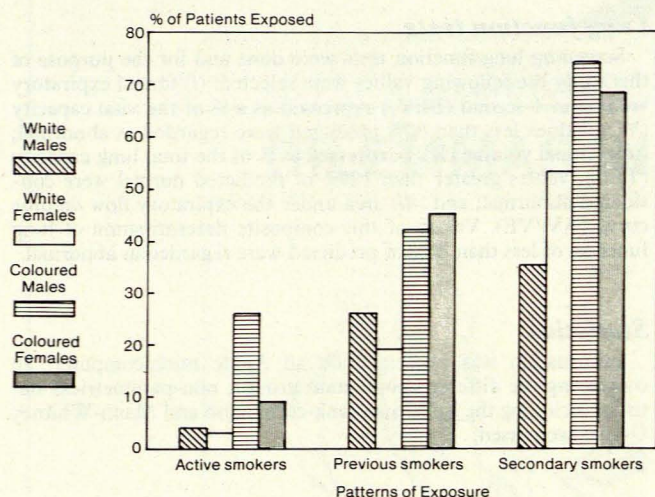


Fig. 1. Exposure to cigarette smoke in the two different population groups.

Sensitivity to specific antigens

As indicated in Table I sensitivity to house-dust mite was an important factor in both race groups. Sensitivity for South African grass pollens and for cat and dog dander was more frequent among the white patients ($P < 0,01$). Sensitivity for the fungus *A. fumigatus* ($P < 0,05$) and the parasite *A. lumbricoides* ($P < 0,02$) was of significant importance among coloured patients. Out of the total of 118 patients, only 4 of the white (7%) and 4 of the coloured patients (6%) were negative for all of the chosen skin-prick tests.

TABLE I. PERCENTAGE SENSITIVITY TO SPECIFIC ANTIGENS

	House-dust mite	SA grass	Cats, dogs	<i>A. fumigatus</i>	<i>A. lumbricoides</i>
Whites	74	51	57	5	5
Coloureds	76	22	32	19	21
	NS	$P < 0,01$	$P < 0,01$	$P < 0,05$	$P < 0,02$

Distribution of abnormal lung function

Equal points were allocated for abnormal FEV₁/VC and for the RV/TLC and AV/VE tests (Table II). As defined by these three lung functions 74% of the white opposed to 95% of the coloured patients had abnormal lung function ($P < 0,01$).

Total serum IgE levels

The mean value of 516,25 kU/l for whites was not significantly different from the mean value of 602,87 kU/l for coloured patients. There was no significant difference between the total serum IgE values for male and female patients.

TABLE II. RESULTS OF LUNG FUNCTION TESTS (%)

	FEV ₁ /VC and/or RV/TLC abnormal	FEV ₁ /VC normal, RV/TLC abnormal	AV/VE abnormal	All tests normal
White males	76	19	43	24
White females	73	28	33	27
Coloured males	94	5	71	6
Coloured females	90	26	40	7

Abnormal radiographs

In 9% of the radiographs of white patients fibrotic lesions were in evidence opposed to the 24% in coloured patients. These figures indicate that lung fibrosis due to previous incidents of acute or chronic infection was a greater problem in the coloured group ($P < 0,01$).

Discussion

An insight into the socio-economic and cultural factors which influence the mechanisms of asthma for individuals and population groups could enhance the ability of doctors to recognise and eliminate causative factors and minimise symptomatic treatment. The two groups of patients studied lived in the same region and the only difference between them was their socio-economic background and possible genetic origin. Table III shows the differences in income between the two population groups in the general outpatient population. The fact that the two groups studied were small and selected in terms of reference to a teaching hospital could be criticised. The latter point is particularly relevant since white patients with mild asthma who can afford private medical service may avoid the tedious procedures of a teaching hospital. This could bias the selection to whites with particularly severe and complicated asthma. This was not the case, however, because on application of well-known criteria for severity of the disease a similar number of white (45%) and coloured (46%) patients had severe asthma. The FEV₁/VC ratio as an index of large-airways obstruction and abnormal RV/TLC in the presence of a normal FEV₁/VC as an indication for small-airways obstruction along with the AV/VE, a composite measurement of large- and small-airways function, indicated abnormality in 95% of coloured and 74% of white patients. These figures are high for both groups owing to inclusion of measurements of small-airways obstruction which are frequently abnormal in asymptomatic asthmatics.¹⁰

TABLE III. MONTHLY-INCOME GROUPS AMONG OUTPATIENTS FROM THE NORTHERN SUBURBS OF CAPE TOWN

Income (R)	No. of whites	No. of coloureds
0 - 50	2027	5810
51 - 100	631	3805
101 - 200	4895	6674
201 - 300	1092	4495
301 - 400	2374	3571
401 - 500	1244	1805
501 - 600	629	908
601 - 700	758	1431
700+	12468	9890
Total	26118	38389

Chi-square test ($P = 1,712 \times 10^{-8}$).

The complexity of the asthmatic syndrome in any individual or population group is compounded by a great variety of aetiological agents in the home and in the occupational environment. The mean total IgE values were abnormally high (> 600 kU/l), but similar for both population groups indicating an enhanced tendency to react to antigens in the environment. Identification of antigenic factors which represent important aetiological factors in allergic asthma for different population groups could be of great value in educating specific patients. House-dust mite was the commonest identifiable IgE response in 74% and 76% of the white and coloured population groups respectively — a finding similar to other temperate regions of the world and in keeping with the high mite counts in coastal regions of the RSA.^{11,12} Grass pollens and pet antibodies which occurred more commonly among white than coloured patients may relate to childhood exposure in the homes and gardens of white patients. The *A. fumigatus* and *A. lumbricoides* IgE-mediated skin-prick responses were found more frequently in coloured patients than whites. *A. lumbricoides*, a common parasitic infestation among coloured children, has a potent IgE-enhancing effect and the subsequent parasite-specific immunogenic response has been shown to correlate with an enhanced tendency to asthma.^{4,13} In the same study⁵ the anti-parasite-IgE response paralleled enhanced production of antibodies to common inhaled environmental antigens. Elevation of both the total and specific environmental IgE responses provided a good explanation for the high incidence of asthma in patients with an allergy to *A. lumbricoides*.⁵ *A. lumbricoides* allergy secondary to parasite infestation relates to contamination from ascaris-infested soil in children and in adults to the eating of unwashed vegetables and fruit. This extremely potent inducer of an IgE response could be avoided by encouraging patients to apply simple hygiene measures such as thoroughly washing raw fruit and vegetables before consumption. Identification of *A. lumbricoides*-allergic individuals and treatment for infestation is another important long-term goal in the control of asthma.⁵

Respiratory infections have been proved to be one of the most common inducers of severe asthma and in one study accounted for two-thirds of severe attacks in children and one-third in adults.² Gregg³ found that 10% of previously healthy adults developed a wheeze during rhinovirus infection whereas in the asthmatic group more than 80% wheezed after a similar infection. In two studies from the western Cape region, upper respiratory tract infections in 50% of 100 adult asthmatics and upper and lower respiratory tract infections in 59% of 40 children have been shown to be associated with severe asthma.^{14,15} Recurrent acute bronchitis was a problem among 35% of 55 white and among 59% of 63 coloured patients ($P < 0,05$). These recurrent infections could not be attributed to chronic bronchitis since only 3,6% of the total white and 6,3% of the coloured group had a history compatible with this disease. In the RSA the high incidence among non-white patients of tuberculosis and other destructive pulmonary infections, which leave residual fibrotic and structural lung damage, creates a potential source of recurrent bronchial infections which may serve as a complicating factor in allergic asthma.¹⁶ Radiological evidence of previous structural lung damage was recorded on radiography in a small number of white (9%) and 24% of coloured patients. The radiological changes noted in the two population groups may be of relevance to the higher incidence of respiratory tract infections specifically due to localised chronic bronchitic or bronchiectatic changes. Bacterial infection has not yet been proven to be associated with acute asthma to the same degree as viral bronchitis but early administration of antibiotics to prevent or attenuate severe asthma during acute bronchitis is good clinical practice.

Among all South African population groups the coloured population has been found to be the heaviest smokers.¹⁷

Smoking causes an increase in airway resistance in both normal people and patients with respiratory disease; it also causes hypertrophy of bronchial mucous glands and inhibits bronchial ciliary action.^{18,19} All these effects are particularly harmful in patients with abnormal bronchial function due to allergic asthma. A history of past or present smoking was in evidence in 29% of white and 62% of coloured patients respectively. This high percentage for direct exposure to cigarette smoke in asthmatics correlates with the figure of 44% reported by Westerman *et al.*¹⁴ for a group of 100 coloured asthmatics studied. A further 28% of white patients and 24% of coloured patients in Westerman *et al.*'s¹⁴ study were exposed to heavy concentrations of secondary cigarette smoke at home or at work. This has been shown to enhance small-airways obstruction in non-smokers exposed to secondary cigarette smoke in their working environment.⁸ It is apparent that greater personal and public awareness of the harmful effects of exposure to cigarette smoke needs to be stressed among Third-World asthmatics. This is particularly relevant in infants and young children due to the higher incidence of respiratory disease in homes where one or both parents smoke.^{20,21}

Although unquestionably an ideal method of drug delivery to the airways, with an immediate response in the case of β -stimulants, the success of long-term prophylactic administration with inhalers has been limited — due mainly to hand-mouth inco-ordination.^{9,10} In a study conducted on British patients, 18% of patients, 135 of whom had been using the inhaler for a prolonged period, were found to have an inadequate technique.¹⁰ This problem is compounded in Third-World patients by a general non-compliance in the use of prophylactic drugs in asthmatics. In a study¹⁵ conducted at the Red Cross War Memorial Children's Hospital, Cape Town, 45% of severe asthmatic children acknowledged or were suspected of not using prophylactic treatment as prescribed and 40% of 100 coloured adult asthmatics in Westerman *et al.*'s¹⁴ study who had been admitted for severe asthma were found to be non-compliant.¹⁶

When three reasons for inadequate inhalation therapy were considered, i.e. non-renewal of scripts, treatment on demand and hand-mouth inco-ordination, 60% of coloured and 27% of white patients were inadequately treated. In spite of regular and repeated education sessions the predominant source of error was that patients administered inhalation treatment on demand and that inhalers were used incorrectly. In coloured patients these two problems were evident in 49% and 35% respectively, but also occurred in 22% and 11% of white patients respectively. The successful prevention of asthma depends to a large extent on adequate and regular prophylactic treatment. In Third-World patients the cost factor has to be considered since long-term prophylactic treatment for asthma has become a major source of expense for individual and state budgets. The use of long-acting oral β -stimulant preparations with blood level control may provide an acceptable alternative to regular inhalation prophylaxis. This would not preclude the use of inhaled bronchodilators during asthmatic crises or on demand — a means of administration which is familiar to most patients.

It is evident from this study that an understanding of the social and cultural habits of individual patients and of population groups, as well as of their philosophy of drugs and disease, is of paramount importance in understanding the disease itself and in controlling it successfully.

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Rheumatic fever in an urban community

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Summary

Forty-six children with acute rheumatic fever were admitted to Coronation Hospital, Johannesburg, between April 1981 and December 1984; 4 of them were admitted twice during this period. Their ages ranged from 4,5 years to 12,4 years. Carditis was present in 26 patients, arthritis in 22, chorea in 14, subcutaneous nodules in 3 and erythema marginatum in 2. Three patients died and a further 3 had to undergo emergency valve replacement for intractable cardiac failure. Thirty-five developed rheumatic heart disease; they all had mitral regurgitation. Compliance with prophylaxis was acceptable in only 22 cases.

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Acute rheumatic fever (ARF) and its cardiac sequelae remain a common and often devastating problem in children and occur more frequently among those reared in overcrowded, underprivileged circumstances.¹ At Coronation Hospital, Johannesburg, which is one of the five teaching hospitals of the Faculty of Medicine of the University of the Witwatersrand and primarily serves the coloured (of mixed origin) and Indian communities of the Witwatersrand, an average of 1 of the approximately 140 children admitted every month has ARF.

The demographic data available for the area are too vague to give an overall denominator. The purpose of this article is to record the pattern of the acute manifestations and sequelae of ARF in these children.

Patients and methods

Data were gathered prospectively on all patients admitted to the paediatric department of Coronation Hospital who fulfilled the modified Jones criteria for the diagnosis of ARF² with the qualifications discussed by Feinstein and Spagnuolo.³ All patients who fulfilled these criteria were admitted and, although this was a hospital-based study, were therefore not specially selected other than by the fact that they had come to hospital. The study began in April 1981 and ended in December 1984, during which time an average of 1 680 paediatric patients were admitted annually. For most of this period the upper age limit for admission to the paediatric wards was 12 years.

To assess the degree of crowding to which these children were exposed, data were collected in as many cases as possible regarding the number of people per sleeping room in the patient's home and the number of children per classroom at school. The classroom and the bedroom were considered to be the two places where the children spent most of their time and thus, if overcrowded, where they would be most likely to acquire streptococcal pharyngitis.

The following laboratory tests were done on each patient by the South African Institute for Medical Research: a full blood count, measurement of the erythrocyte sedimentation rate (ESR) (Westergren), antistreptococcal antibodies and the C-reactive protein level, and a throat swab culture.

Results

A total of 46 patients (50 attacks of ARF) were studied, of whom 26 were girls and 20 boys. The mean age on admission (\pm SD) was $9,5 \pm 2,1$ years (range 4,5 - 12,4 years). Fig. 1 illustrates the age and sex distribution.

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