

Childhood bronchial asthma in a desert country

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A 3 year-study of emergency room visits (total 50,300) to the paediatric clinic of the main teaching hospital in Kuwait revealed that the rates of bronchial asthmatic attacks increased significantly from 8.8% of all visits during the 1st year to 14.9% during the 3rd year. The seasonal distribution of asthmatic attacks showed maximum rates during the winter and minimum values in the summer, giving a very close inverse correlation to temperature and direct correlation to relative humidity. A similar, excellent correlation was seen between asthmatic attacks and upper respiratory infections. Occurrence of atmospheric pollen, which characteristically shows a bi-annual pattern in Kuwait, was not found to correlate with asthma attack rates. Neither was there any demonstrable effect of dust storms on the frequency of asthmatic attacks in the children. Independent of season, the boy to girl ratio among the asthma cases was remarkably constant, around 2:1.

Key words: childhood bronchial asthma; climate; epidemiology; respiratory infection.

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The prevalence of bronchial asthma appears to be increasing all over the world. Hospital admission rates for childhood asthma have increased 3-10-fold during the sixties and seventies in a number of industrialized countries (17). In Kuwait, a small desert country, bronchial asthma was considered a rare disease before the fifties (21). In 1978, however, a WHO report was published estimating the prevalence of bronchial asthma at 10% and in a recent study this figure was reported to be 18% (7). Previous studies of bronchial asthma in Kuwait have mainly concerned adults and no specific study of childhood asthma has been made. The present study was undertaken in an attempt to define the magnitude of the problem of childhood asthma in Kuwait and also, by studying seasonal variations of the disease, to obtain information about possible factors that may play a role in the causation and precipitation of childhood asthma.

PATIENTS

The study included all 1-12-year-old children who during a 3-year period, visited the emergency room in Mubarak-Al Kabeer Hospital, which is the main teaching hospital in Kuwait.

A diagnosis of bronchial asthma was made in children with signs of lower airways obstruction as evidenced by breathing difficulty, cough, wheezing and rhonchi. Most of the several doctors serving in the emergency room had been instructed by us about diagnostic criteria. In the majority of cases, diagnoses of asthma in hospitalized children were made by one of us (I.-L. S.). An indication that diagnoses made in the emergency room would be reliable, if not rigorous, was obtained in retrospect by the finding of parallelism between asthma attack rates in emergency room visitors and hospitalized cases, as well as the constant boy to girl ratios in both patient categories (see below). Because of the

Table 1
Emergency room visits and admission of cases with asthma and URTI

Year	Total cases	No. with asthma (%)	No. hospitalized with asthma (%)	No. with URTI (%)
1982-83	17 680	1 558 (8.8)	399 (2.3)	5 255 (29.7)
1983-84	17 060	2 176 (12.8)*	419 (2.5)	5 180 (30.4)
1984-85	15 560	2 322 (14.9)*	475 (3.1)	4 403 (28.3)
Total	50 300	6 056 (12.0)	1 293 (2.6)	14 838 (29.5)

*Increases in rates are statistically significant.
1982-83 to 1983-84 $P < 0.001$; 1983-84 to 1984-85 $P < 0.001$, χ^2 test.

controversy about whether or not wheezy bronchitis and bronchial asthma are different entities, children under 1 year with a diagnosis of either asthma or bronchitis were not included in the study. The patient nationalities mirrored the multinational composition of the population of Kuwait. Thirty-six percent of the children were Kuwaitis and most of the others were Palestinian, Jordanian, Syrian, Egyptian or Indian. Only a small minority of the children came from Europe or the United States.

The children were treated in the casualty department with salbutamol inhalation. If the patients did not respond to this treatment but

needed i.v. fluids, aminophylline, hydrocortisone and further medication with beta₂-stimulants, they were admitted to hospital.

RESULTS

The emergency room patients were investigated during the period 1 July 1982-30 June 1985. During these 3 years there were 50,300 visits of which 6,056 (12%) were due to bronchial asthma. Because a decrease in coverage population area took place in 1984, a slight decrease in total emergency room visits was observed in 1984-1985. A total of 10,181 children were hos-

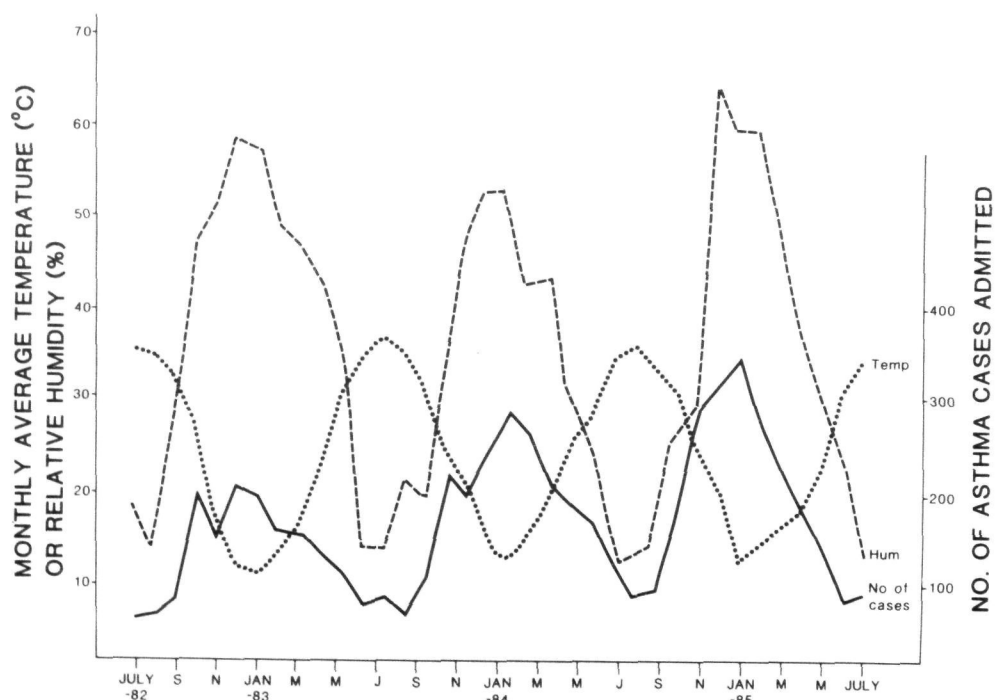


Fig. 1. Relationship between temperature, relative humidity and number of emergency room visits for asthma. The numbers of asthma diagnoses in the emergency room in the hospital during each month of the 3-year study are indicated. Relative humidity is expressed as mean of maximum and minimum humidity.

pitalized, of whom 1,293 (12.7%) had bronchial asthma. The annual distribution of patients during the period investigated indicated a progressive increase in asthma admission rates from 8.8% to 14.9% (Table 1). This increase was statistically significant (chi-square test, $P < 0.001$). A similar, although not statistically significant, increase was observed for cases hospitalized with asthma. There was no increase in the number of visits of children with upper respiratory tract infection (URTI).

The seasonal variation of asthma admissions followed a regular pattern, peaking during December/January and with low levels in the summer. Thus, there was a remarkable inverse correlation between temperature and number of asthma diagnoses (Fig. 1). The same type of correlation was obtained also when asthma admission rates were expressed as percentage of total number of visits to the hospital, indicating that the low levels in the summer months were not due to the overall decline in number of hospital visits during these months.

A small peak in the asthma rate curves in October (Figs. 1, 2) suggested a possible influence of allergenic, atmospheric pollen, which is

prevalent in Kuwait during this month. The occurrence of atmospheric pollen, however, including that of *Prosopis juliflora*, which is considered to be the major allergenic pollen in Kuwait (7), characteristically shows a bi-annual distribution, peaking in August/October and April/May (12). As seen in Fig. 2 there was no change in the downward trend of asthma admission rate curves during April/May and, thus, there was no indication that atmospheric pollen was a major cause of asthmatic attacks in the children.

Since the incidence of URTI could be assumed to be season-dependent, a comparison was made between rates of URTI and asthma admission. With the exception of the previously mentioned asthma rate peak in October there was an excellent correlation between asthma and URTI diagnoses (Fig. 3). Thus, throughout the year the URTI admission rates were 2-2.5 times higher than those of the asthma rates.

Because of the possibility that sex differences might account for differences in susceptibility to various asthma precipitating factors, the sex distribution of asthma cases during the various

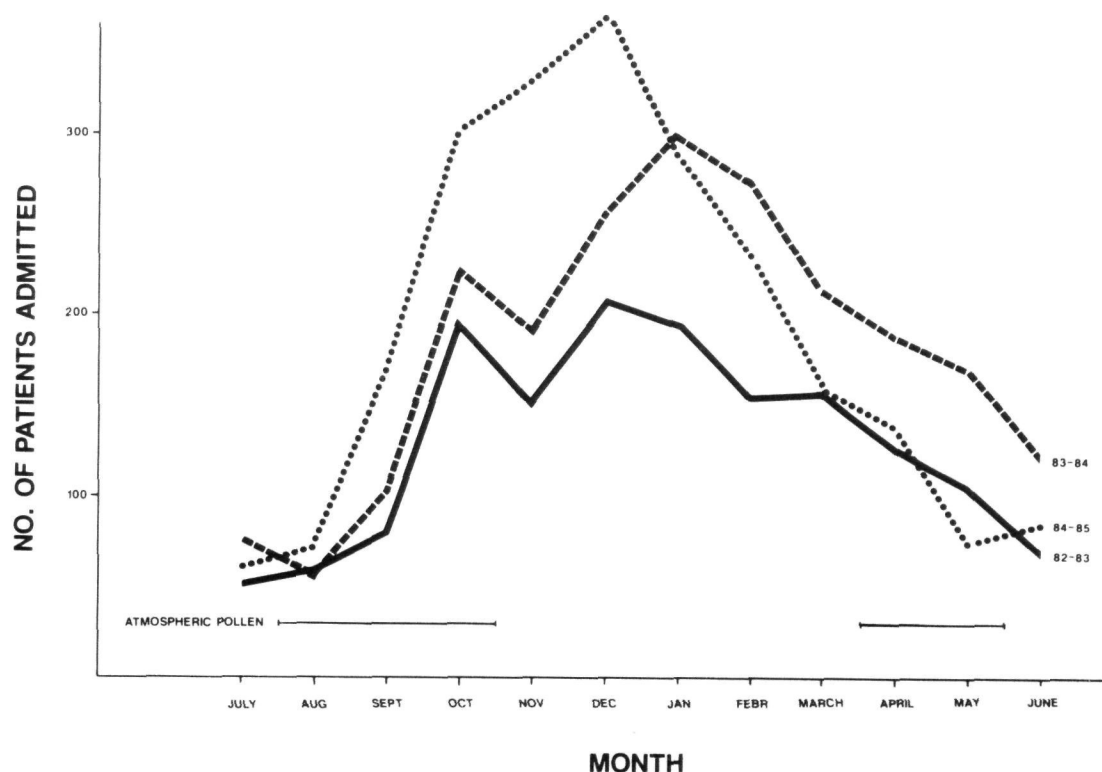


Fig. 2. Seasonal variation of rates of asthmatic attacks in relation to the occurrence of atmospheric pollen.

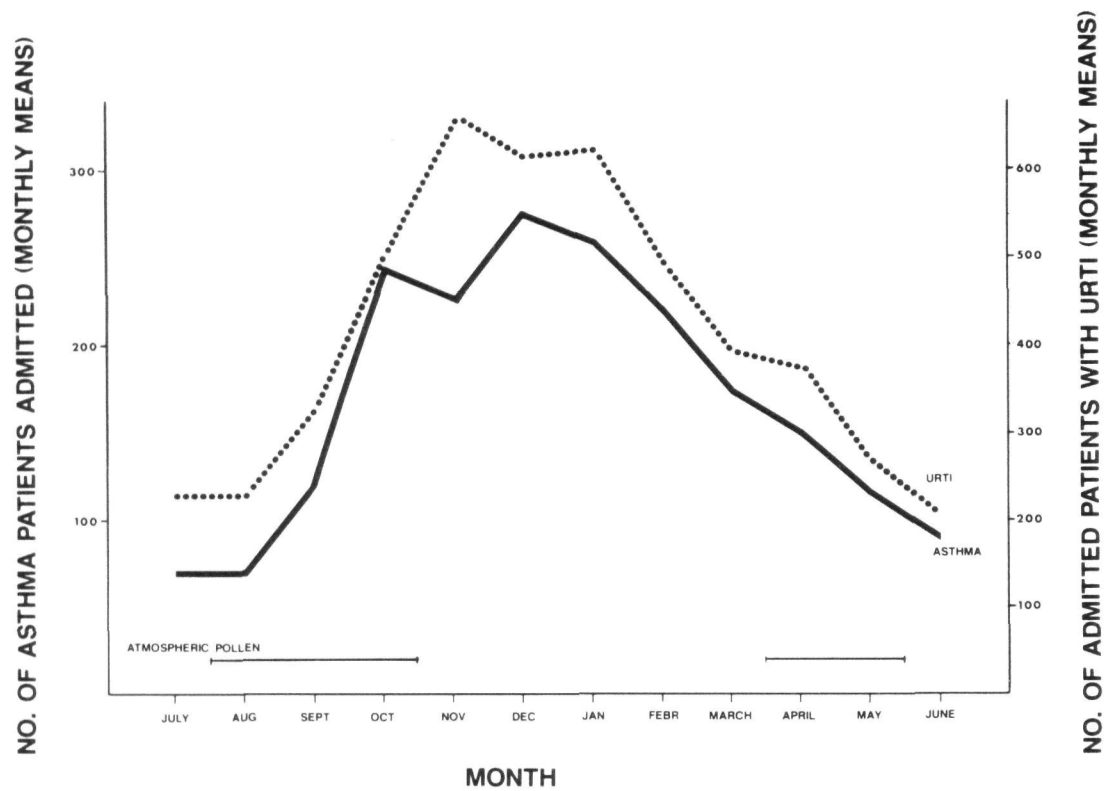


Fig. 3. Seasonal variation of asthma attacks and upper respiratory infection (URTI)
Curves illustrate the mean monthly numbers of cases with asthma and URTI during the 3-year study period.

seasons was recorded. There was a remarkably constant boy to girl ratio of about 2:1 throughout the year.

Various weather conditions have been associated with precipitation of asthmatic attacks and it was therefore considered of interest to study the influence of climatological factors other than temperature. The relative humidity in Kuwait varies with the temperature, being relatively high in the cold months (60–70 %) and very low in the summer (10–15 %). Accordingly, the curves for variation of relative humidity closely followed asthma rate curves. However, when a comparison was made between asthma attack rates during the 2 days with the highest and the

2 with the lowest relative humidity within each month, there was no significant difference between the rates (11.7 % and 12.3 % of all visits, respectively). Thus, eliminating the effect of seasonal variation, there was no indication that short-term changes in the relative humidity influenced the asthma attack rate.

Dust in the air is commonly thought to be a major causative factor for the precipitation of asthma in Kuwait. Dust storms occur most frequently in the early summer; however, that is at a time when asthma attacks were found to be relatively infrequent in the present study. During the 3-year study period dust storms occurred during a total of 90 days. As seen in

Table 2
Lack of effect of dust storms on asthma admission rate

Weather condition	No. days	No. emergency room visits	No. with asthma (%)	No. of patients hospitalized	No. of hosp. asthma cases (%)
Dust storm	90	3 739	379 (10.1)	784	89 (11.4)
Clear; no storm or rising dust	90*	3 892	380 (9.8)	792	97 (12.2)

*Control days were selected as the days labelled as “clear” or “hazy” preceding and closest to a day with dust storm.

Table 2 the number of asthma diagnoses during days with dust storms was almost exactly the same as the number during control days, i.e. days labelled as "clear" and "hazy" and immediately preceding a day with dust storm. The lack of difference was apparently not due to the possibility that only severe cases were admitted during days with dust storms, since the relative numbers of severe (hospitalized) cases were about equal in the two groups.

DISCUSSION

Bronchial asthma is the most common chronic lung disease in children and frequently a cause of emergency room visits and admission to hospitals (5, 13, 14). The prevalence of bronchial asthma in children in the Western world varies, but has generally been reported to increase during recent decades (13, 17, 18). Reports on bronchial asthma from developing countries are scarce but it seems that the prevalence in these countries is generally considerably lower, in some cases to the extent that asthma in children is considered a rare disease (1, 11).

Because of the possible association of asthma with factors related to industrialization, it was considered of interest to study childhood asthma in Kuwait, which has undergone an extremely rapid development during recent decades. Bronchial asthma was claimed to be rare 30 years ago (21) but the prevalence since then has apparently been increasing dramatically (7). The results of the present study, which comprised more than 6,000 diagnosed episodes of bronchial asthma in children, indicated that over a 3-year period there was a significant increase in emergency room visits because of bronchial asthma. These findings thus support earlier results obtained in adults and would be concordant with the suggestion that the frequency of bronchial asthma in fact parallels the change of Kuwait from a poorly to a highly developed country. It should be stressed, however, that the present study concerned only exacerbation of asthma and not prevalence and, therefore, cannot be taken as proof that the prevalence of asthma in children has actually increased during this short period.

The reasons for the apparent increase in prevalence of asthma and, as observed in the present study, increase in incidence of asthmatic attacks in children in Kuwait, are not understood. A possibility to be considered would be the introduction of new allergens into the population. Contrary to common belief, atmospheric pollen occurs rather abundantly in Kuwait. The most important of the allergenic pollen is that from the mesquite tree (*Prosopis juliflora*), which was introduced into the country from Iran in 1951 (7). Mesquite pollen is a potent allergic sensitizer and we have found a very high prevalence of IgE antibodies to this pollen among asthmatic children in Kuwait (unpublished results). However, there was no evidence that mesquite pollen played any role in the precipitation of asthmatic attacks in children. In fact, peak incidences of asthmatic attacks regularly occurred during seasons with minimal airborne pollen. Apart from the mesquite, no newly introduced allergens have been identified which could be suspected as a major causative factor in asthma. However, in many parts of the world allergy to mites appears to be strongly increasing. For example, a dramatic increase of asthma prevalence in certain areas in New Guinea has been considered related to introduction of mites (6). The possible relationship between bronchial asthma and mite allergy was not addressed in the present study. However, although the mites, *Dermatophagoides pteronyssimus* and *farinae*, which are known to be major allergens in other parts of the world, are not prevalent in Kuwait, other species, like *Tyropagus putrescentiae* and other storage mites occur in relative abundance (10).

Another obvious potential reason for an increasing asthma prevalence would be air pollution. It has been found that children living in highly polluted areas have an increased asthma prevalence compared with those living in non-polluted but otherwise similar areas (2, 3). In Kuwait air pollution has increased dramatically during recent years, primarily due to the continuously increasing volume of traffic.

The seasonal variation in incidence of asthmatic attacks found in the present study gave some clue as to the relative importance of precipitating factors. In earlier investigations

precipitation of asthmatic attacks has been associated with decrease in temperature, decrease or increase in humidity or barometric pressure, and decrease in wind velocity (19). In the present study there was an excellent correlation between low temperature and high rate of asthma visits. Although the temperature is never very low in Kuwait, a change from indoor to outdoor temperature might be sufficient to provoke asthmatic attacks in predisposed children during the cold season. Cooling of the airways is a well-known means of provoking attacks in asthmatic children (9, 16).

Since the temperature correlates inversely with relative humidity in Kuwait the seasonal distribution of asthma admissions was also well correlated to humidity. When the seasonal variation in humidity was disregarded, however, and only days with the highest and lowest humidity within each month were considered, there was no correlation between relative humidity and asthma admission rate. It is still possible, however, that high humidity might indirectly play a role in the causation of asthma, by creating favourable conditions for allergenic mites.

It is a common belief in Kuwait that dust in the air may provoke asthmatic attacks. Dust storms occur most frequently during the hot months of the year. In the present study there was no indication that the occurrence of dust storms influenced the asthma admission rates. In other studies the impact of storms has been attributed to increased occurrence of airborne allergens (4), and it is possible that the lack of effect of dust storms in this study was due to the relative lack of such allergens during the time of the year when the storms are prevalent.

Our most conspicuous finding, apart from correlation with temperature and humidity, was the very close correlation between asthmatic attacks and upper respiratory tract infections (URTI). It is well known that URTI may provoke asthma via a multitude of mechanisms (8). Considering this relationship and the covariation of temperature and frequency of URTI it seems most likely that the influence of temperature on asthma admission rates is more apparent than real, and that the most important

causative factor for asthma attacks is in fact URTI.

It is interesting to note that asthma admission rates were consistently about twice as common in boys as in girls. A boy-girl ratio of about 2:1 has been observed in a number of other studies (15, 18, 20) and was in the present study found to be remarkably constant during the various seasons of the year. This would indicate that, irrespective of the offending factor which precipitates the attack, boys are constitutionally more prone to develop bronchial asthma than girls. A greater bronchial lability in boys has in fact been claimed to be responsible for their tendency to develop bronchial asthma (20).

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REFERENCES

1. Abdurrahman, M. B. & Taqi A. M.: Childhood bronchial asthma in northern Nigeria. *Clin. Allergy* 12, 379-384, 1982.
2. Andrae, S., Axelsson, O. & Björkstén, B.: Symptoms of bronchial hyperreactivity and asthma in relation to environmental factors. *Arch. Dis. Child.* 63, 473-478, 1988.
3. Berciano, F. A. & Domínguez, Alvarez, F. V.: Influence of air pollution on extrinsic childhood asthma. *Ann. Allergy* 62, 135-141, 1989.
4. Brown, H. M. & Jackson, F.: Asthma and the weather. *Lancet* ii, 630, 1983.
5. Conway, S. P. & Littlewood J. M.: Admission to hospital with asthma. *Arch. Dis. Child.* 60, 636-639, 1985.
6. Dowse, G. K., Turner, K. J., Stewart, G. A., Alpers, M. P. & Woolcock, A. J.: The association between Dermatophagoides mites and the increasing prevalence of asthma in villages within the Papua New Guinea Highlands. *J. Allergy Clin. Immunol.* 79, 457-466, 1986.
7. Ellul-Micallef, R. & Al-Ali S.: The spectrum of bronchial asthma in Kuwait. *Clin. Allergy* 14, 509-517, 1984.
8. Frick, O. L., German, D. F. & Mills, J.: Development of allergy in children. I. Association with virus infections. *J. Allergy Clin. Immunol.* 63, 228-241, 1979.
9. Galdés-Sebaldo, M., McLaughlin, F. J. & Levison H.: Comparison of cold air, ultrasonic mist and metacholine inhalations as tests of bronchial reactivity in normal and asthmatic children. *J. Pediatr.* 107, 526-530, 1985.
10. Gamal-Eddin, F. M., Aboul-Atta, A. M., Hamad, G. M., Eraki, A. S. M. & Tubeileh M. S.: House dust

- mites in Kuwait: Preliminary pilot survey to shed some light on diagnosis and treatment of mite allergy. *J. Egypt. Soc. Parasitol.* 15, 313-322, 1985.
11. Godfrey, R. C.: Asthma and IgE levels in rural and urban communities of the Gambia. *Clin. Allergy* 5, 201-207, 1975.
 12. Halwagy, M. & Halwagy, R.: Seasonal distribution of pollen grains in the atmosphere of Kuwait. *Pollen Spores* 26, 201-216, 1984.
 13. Lee, D. A., Winslow, N. R., Speight, A. N. P. & Hey, E. N.: Prevalence and spectrum of asthma in childhood. *Br. Med. J.* 286, 1256-58, 1983.
 14. Mak, H., Johnston, P., Abbey, H. & Talamo, R. C.: Prevalence of asthma and health service utilization of asthmatic children in an inner city. *J. Allergy Clin. Immunol.* 70, 367-372, 1982.
 15. Martin, A. J., McLennan, L. A., Landau, L. I. & Phelan, P. D.: The natural history of asthma to adult life. *Br. Med. J.* II, 1397-1400, 1980.
 16. McLaughlin, F. J. & Dozor, A.: Cold air inhalation challenge in the diagnosis of asthma in children. *Pediatrics* 72, 503, 1983.
 17. Mitchell, E. A.: International trends in hospital admission rates for asthma. *Arch. Dis. Child.* 60, 376-378, 1985.
 18. Morrison-Smith, J., Harding, L. K. & Cumming, G.: The changing prevalence of asthma in school children. *Clin. Allergy* 1, 57-61, 1971.
 19. Sly, R. M.: Pediatric allergy. Medical outline series, pp, 55-56. Henry Kimpton Publ, London, 1977.
 20. Verity, C. M., Vanheule, B., Carswell F. & Hughes, A. O. Bronchial lability and skin reactivity in siblings of asthmatic children. *Arch. Dis. Child.* 59, 871-876, 1984.
 21. Wilkinson, W. M. Development of allergy in the desert. *J. Trop. Med. Hyg.* 67, 16-24, 1964.

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